TECHNOLOGY DEPT.

Gas Journal

LIGHT - HEAT - POWER - BY-PRODUCTS

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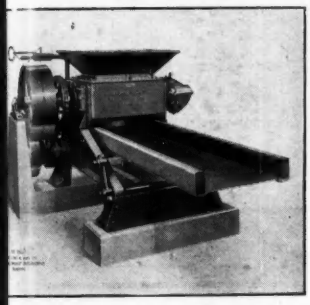
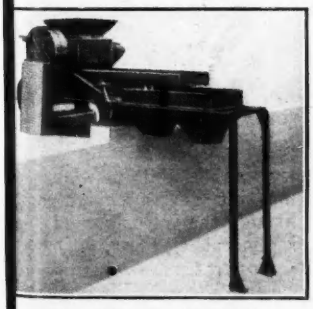
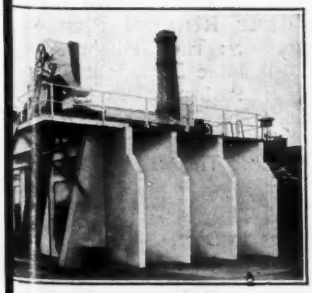


COKE CUTTING MACHINE WITH RECIPROCATING SCREEN



COKE CUTTING MACHINE SCREENING AND BAGGING UNIT



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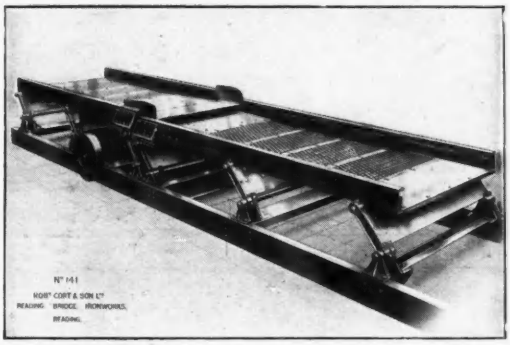

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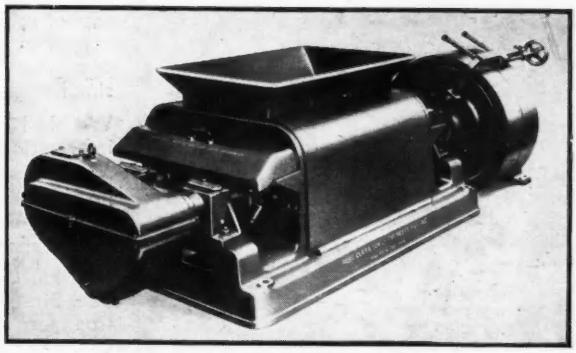

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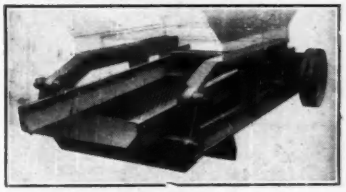
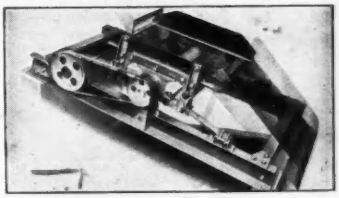


RECIPROCATING DEBREEZING SCREEN



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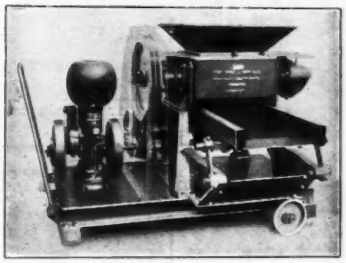

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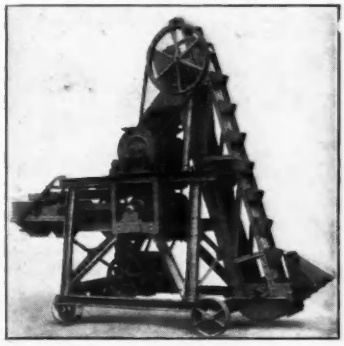

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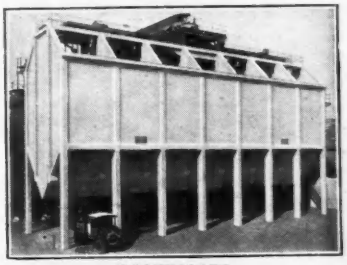

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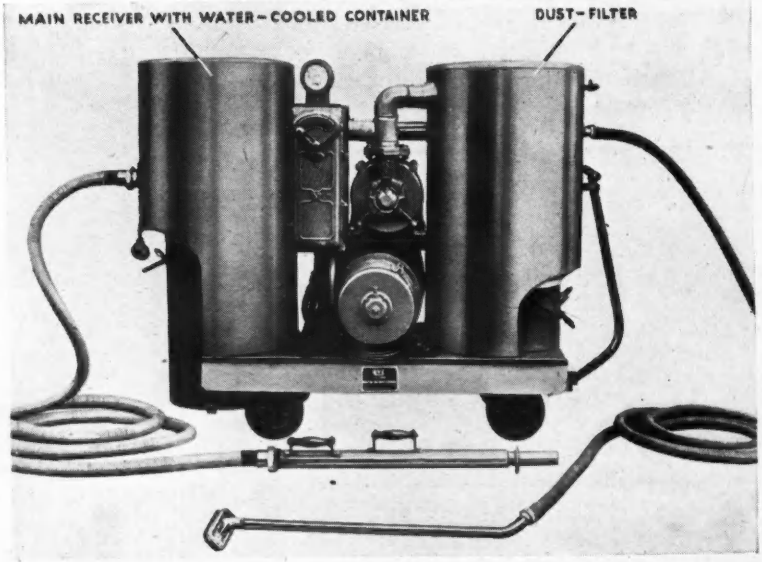

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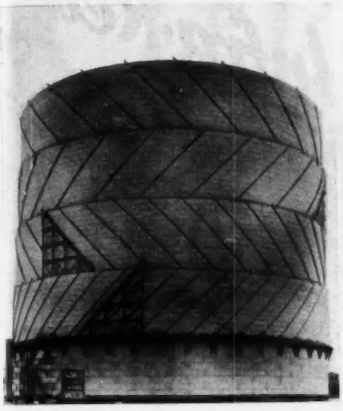
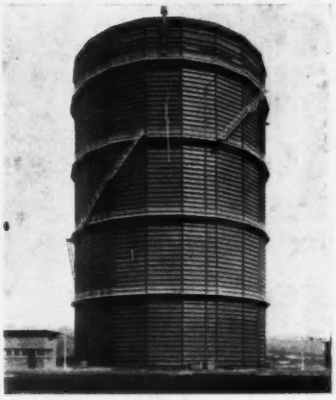
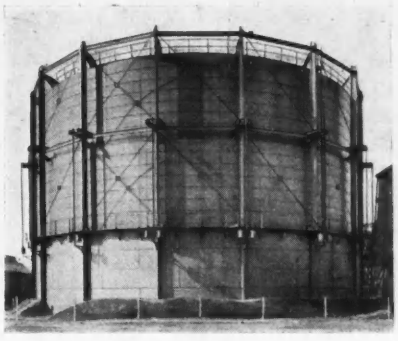
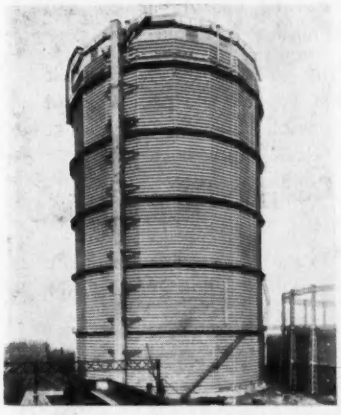
VOL. 246 97th YEAR No. 4293

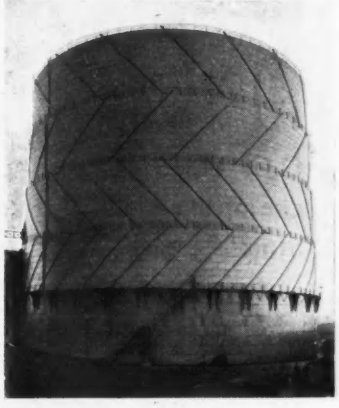
GASHOLDERS BY R&J











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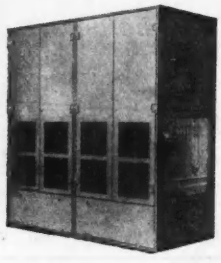

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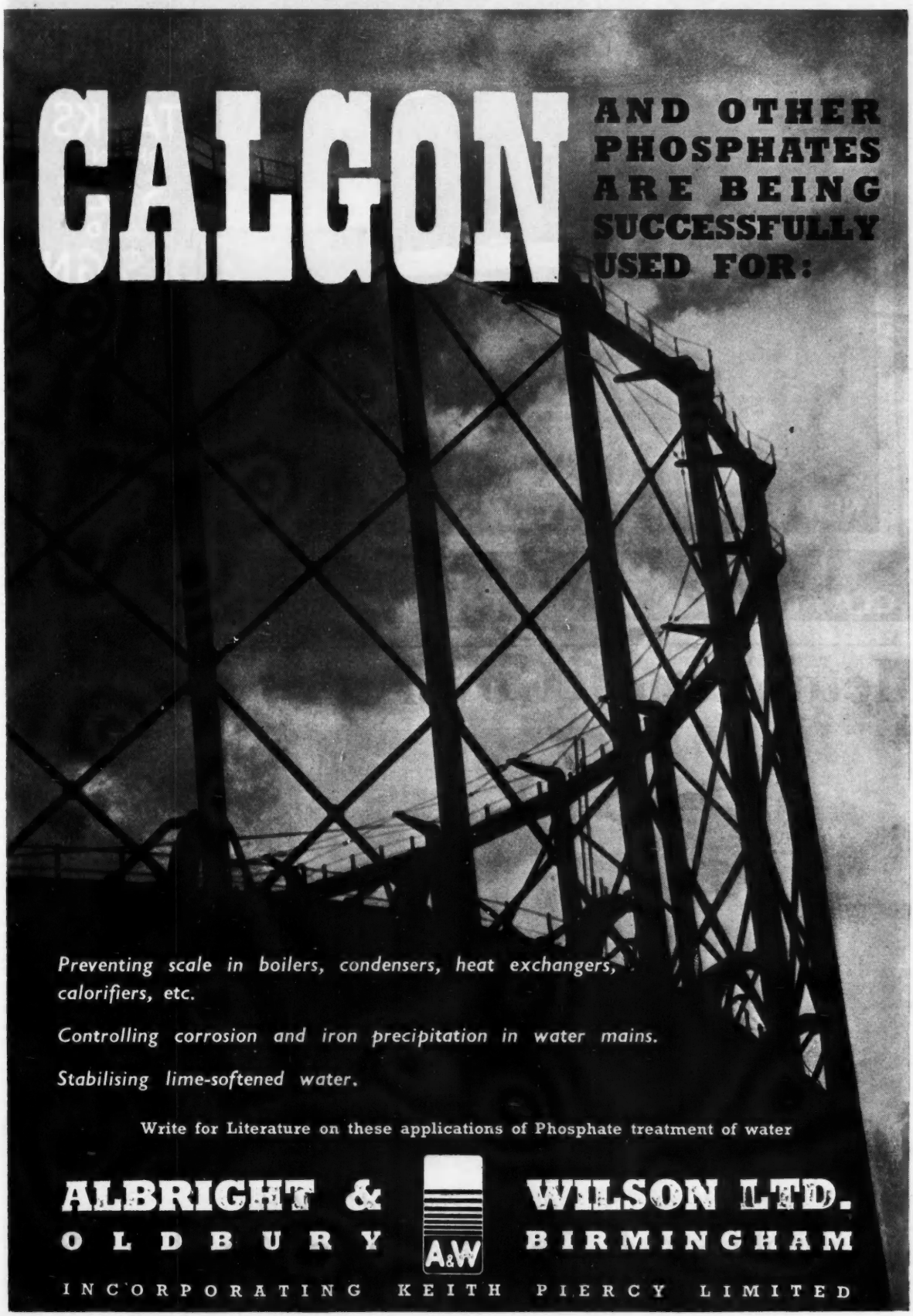
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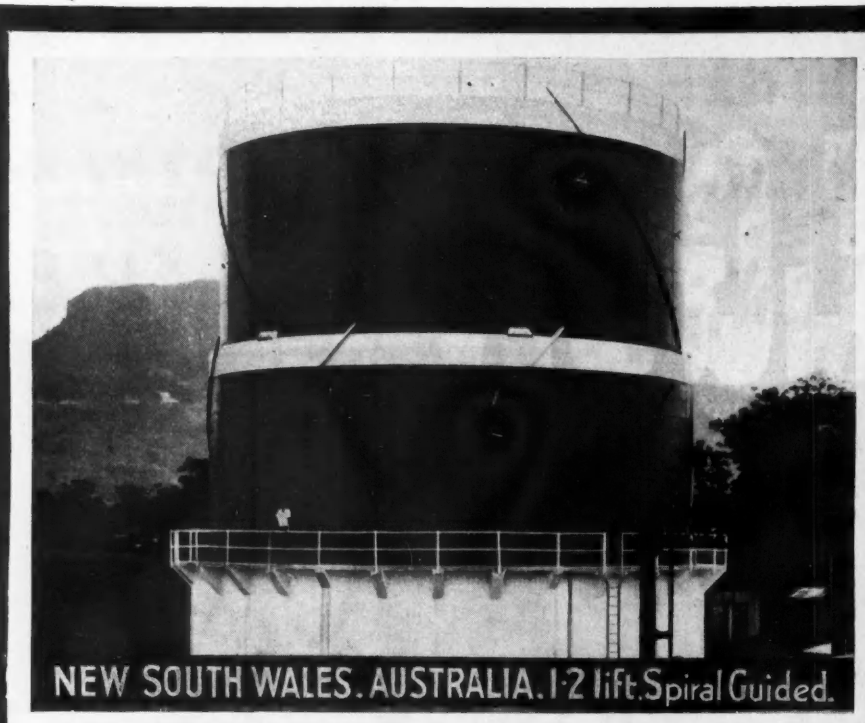

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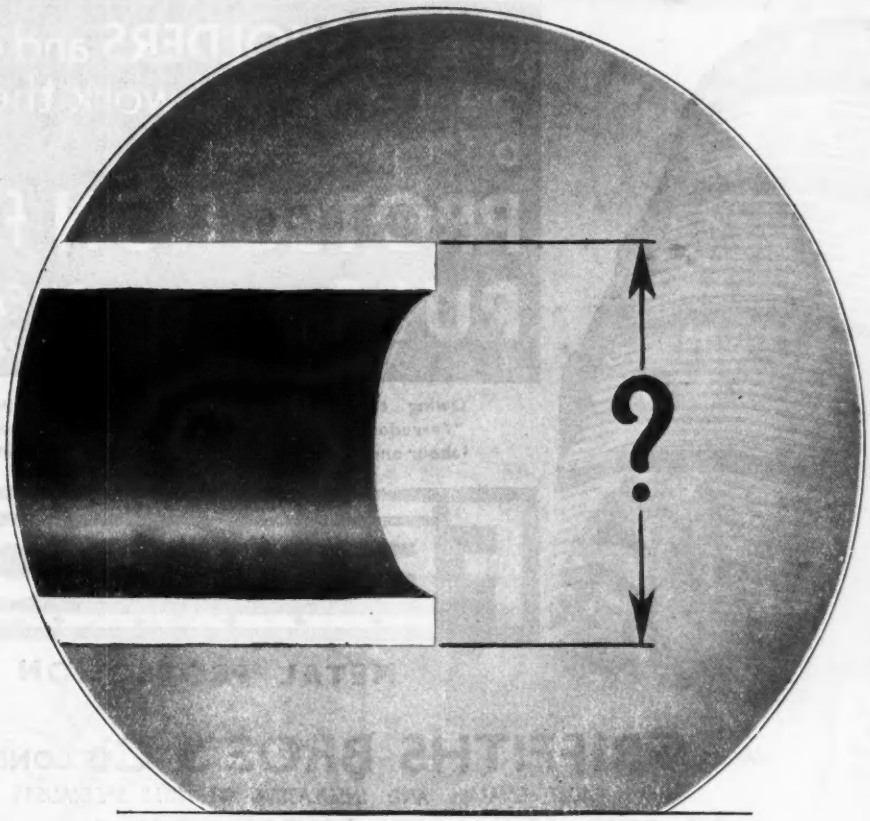

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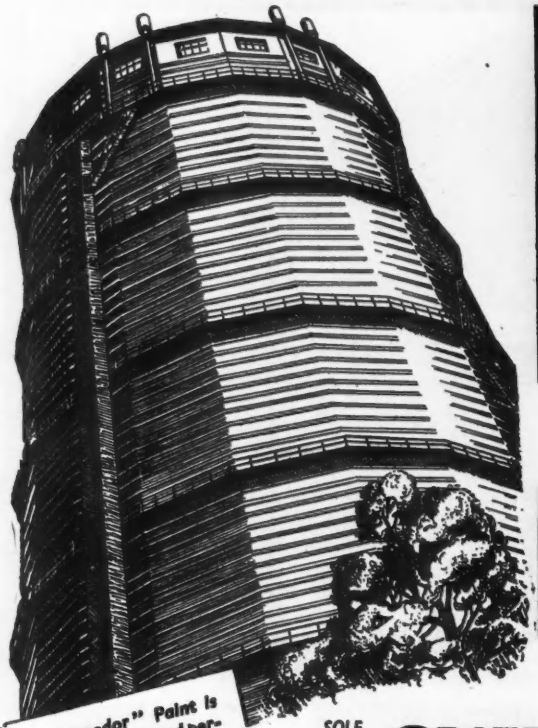

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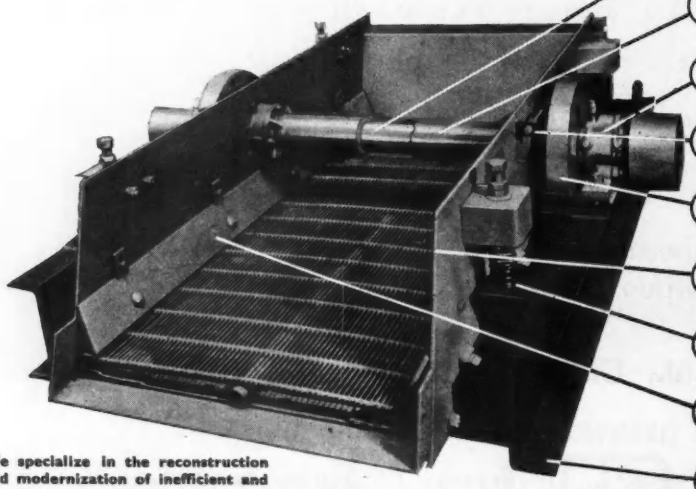

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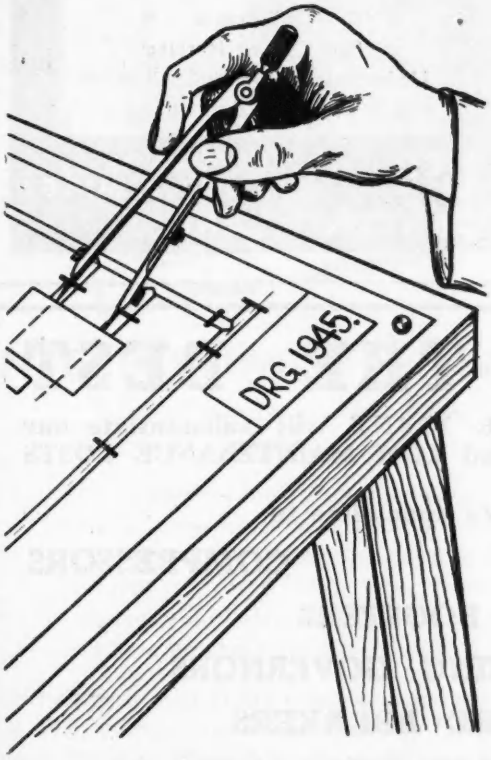

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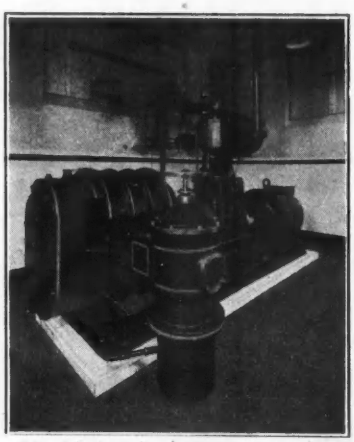

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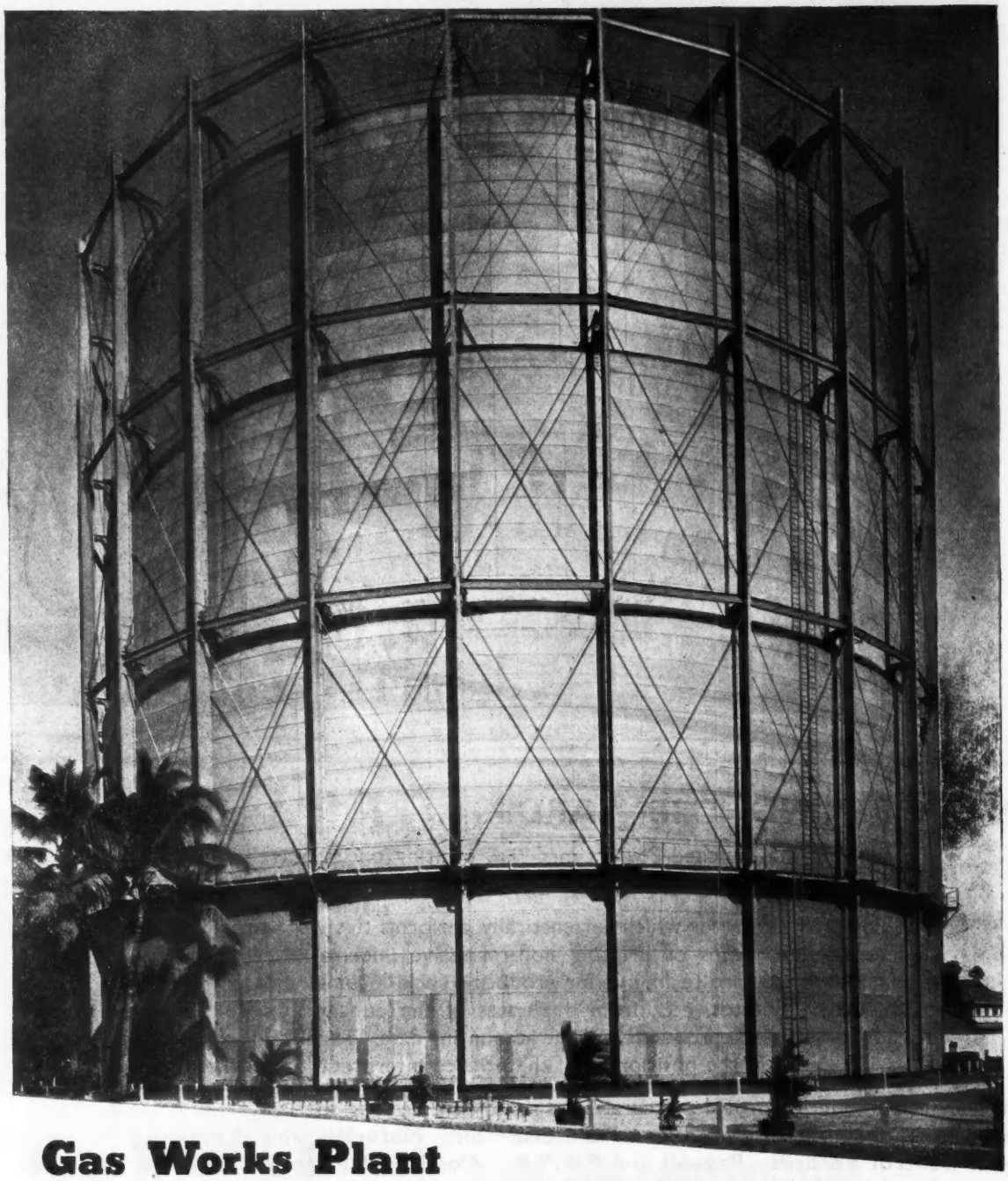

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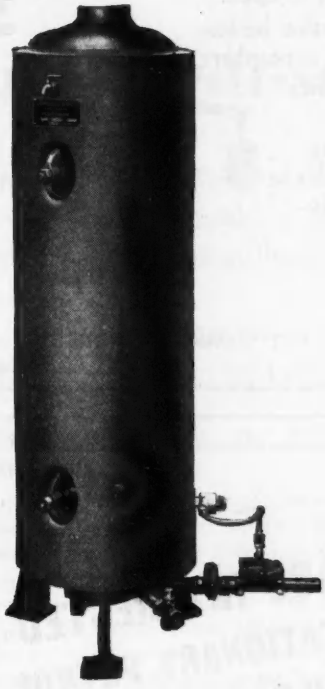

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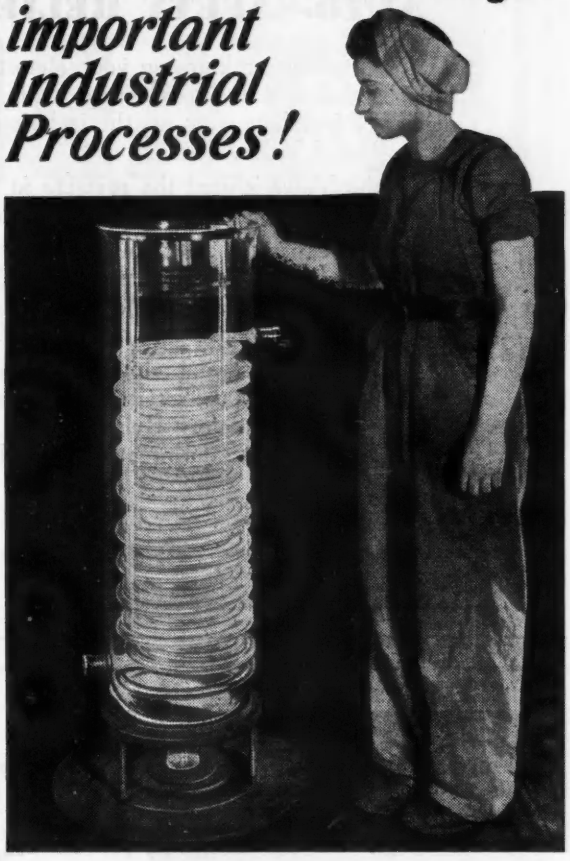

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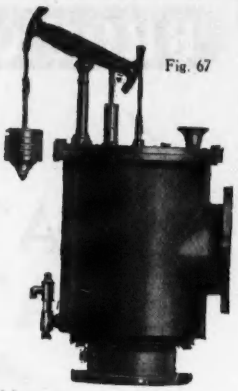

Fig. 67

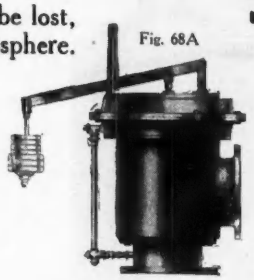

Fig. 68A

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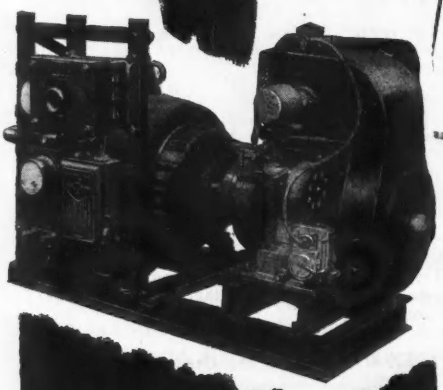

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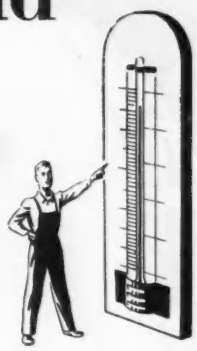

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Here, in condensed form, is a complete guide to the insulation of rooms and buildings to prevent excessive loss of heat.

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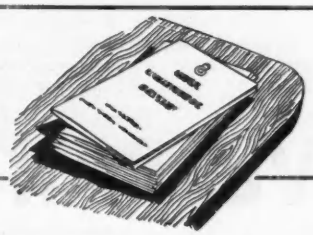

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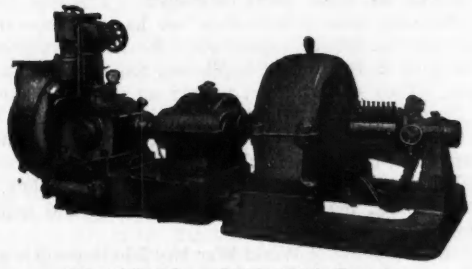

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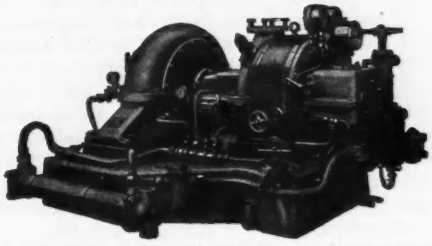

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GAS JOURNAL, AUG. 29, 1945

VOL. 246 97th YEAR No. 4293

EDITORIAL NOTES

ATOMIC ENERGY

THE release by the atomic bomb of a fury of devastating energy which shocked and startled the work loosened, too, a flood of speculation and the expression of an enormous range of comment and diametrically opposed point of view. That we are entering a new era, with a source of energy which may dwarf all others in time to come, seems certain; and itself a source of refined energy, the Gas Industry is naturally vitally interested in this awe-inspiring achievement of the release of atomic energy. Already it has been suggested that he who is plaguing himself about the exhaustion of the coal and oil fields of the world in the next 100 years can, indeed, have few genuine cares. It is a matter of extreme difficulty to picture the possibilities for peacetime purposes of the release of atomic energy, though obviously the possibilities are there, however distant may be their actual application in practice. The problem is as fascinating as it is bewildering to comprehend, and it must be exercising the minds of scientists and others not so scientific in the Gas Industry. We are glad, therefore, to draw attention to the first of a series of articles on atomic energy published in our issue to-day. We believe the series will be helpful as well as stimulating. The Author's approach—and the scientific quality of the Author's treatment will be apparent—has that essence of simplicity and clarity which should have great appeal and should prove refreshing to the thinking man who seeks knowledge and guidance in his natural desire to grasp something at least of this astonishing phenomenon, of the discoveries which had as outcome of one of their manifestations the smoke of destruction which clouded two cities of Japan, and of the implications of this amazing scientific development, made possible by brilliant individual research aided by team work, industrial engineering, and technical skill on a scale hitherto unknown.

GAS IN INDUSTRY

WITH the report in our issue last week of the discussion on the Paper "Gas—in Industry at War," by Mr. H. R. Hems, we concluded publication of the oral discussions on the communications presented at this year's annual meeting of the Institution of Gas Engineers. Mr. Hems' contribution, as the title implied, was concerned with the use of town gas for manufacturing processes in factories connected with the war effort. Before the war started, gas undertakings serving industrial areas experienced increases in consumptions by factories receiving contracts for munitions, civil defence equipment, and particularly aircraft, but at the actual outbreak of war industrial consumptions in some cases temporarily decreased due to the change of plant from peace to war production, except where peacetime products were of a similar nature to those required by the Government war contracts. That the Gas Industry was fully alive to the need for maintaining its vital supply of fuel to the factories and the home is confirmed by the excellent measures which were taken by common consent to meet any interference, particularly by air attack.

As was brought out in the Paper, it was anticipated in the early months of the war that gas undertakings, as the war continued, would find it more difficult to maintain their supplies, particularly during extremely cold weather, and might be compelled to lower gas pressures. It was also anticipated that bombing would have two effects—that of reducing pressure, and that of completely stopping the supply of gas to a factory for an indefinite period. To meet the contingency of pressure reduction it was found that the majority of gas furnaces and industrial equipment could be operated at a gas pressure as low as ½ in. W.G., providing adequate piping was available to supply the volume required, and steps were taken to adjust such apparatus. In London, ½ in. W.G. was adopted; in others 1 in. was taken as standard. As an example, in the areas of one London Company no fewer than 500 factories were serviced in this way. The anticipated effects of bombing were borne out all too soon in practice, and the measures taken to work at subnormal pressures proved their worth in many vital war plants. In some cases where subnormal pressures could not be effective, due to inadequate piping in the factory, boosters were installed which enabled vital plants to continue in production.

To meet complete cessation of gas supply to a factory, supplies of high-pressure gas in cylinders were made available for relatively small vital requirements where it was known that cessation would only be of short duration. For long stoppages, producer-gas plants were considered to be the most satisfactory alternative to the town gas supply, and plants of 2½, 5, and 20 therms capacity per hour were rapidly made available to factories. The producer proved its value both as an emergency measure and for the provision of a fuel supply to the many new factories brought into commission during the war, either in areas not served by a gas undertaking, or in districts where it was not possible for a gas undertaking—due to its already heavy commitments—to allow a supply to be given. Producer-gas plants, the town gas supply, oil, and electricity—each acted as alternatives to one another in the case of interference with the supply of any one source.

The story of the work of the Gas Industry at war is one of unflagging effort amid most difficult circumstances. The salient point is, of course, that the difficulties were overcome. The wartime industrial load, it is salutary to bear in mind, was superimposed on the normal peacetime load; and one hesitates to think how the war production would have suffered had the supply of gas been denied. Gas has had the opportunity of showing its paces; it should receive favourable consideration in the future. Which does not mean that there is room for complacency. In urgent war production economics can go by the board; as peacetime production is stepped-up economical considerations will again assert themselves. The fact does stand out, however, that industrialists are having more and more regard for the labour requirements for heat processes. They are looking favourably on appliances requiring a minimum of labour. They are prepared to pay an increased amount for the therm provided the labour requirement can be reduced. The future will see more mechanized furnaces; the trend will be towards heat-treatment machines in line production—machines utilizing modern technique of mechanical handling, photo-electric timing, maybe, automatic operation and temperature control.

At the beginning of World War No. 2 industrialists turned to the Gas Industry as never before. Had there been unlimited supplies of gas it is impossible to say how much the Gas Industry could have sold for industrial purposes. In the event it is quite remarkable how the Industry coped with demands, some of them wholly new, on top of existing loads. Surely this reflects the greatest credit on industrial gas sales staffs during the inter-war period in that they so educated industrialists that they came to gas as a matter of course. A great deal of goodwill has been built up for our product and our service—goodwill which ought to stand us in good stead. But the comparatively small body of industrial gas engineers and salesmen obviously needs to be expanded. It should be made clear that there are important and remunerative careers open to men who are prepared to

specialize in this direction. And looking to the future we cannot emphasize too strongly the value of personal contacts in all our industrial dealings—which, after all, boils down to a question of planning and co-operation.

BLEAK AND DARK OUTLOOK

AS mentioned in our issue last week, the Minister of Fuel and Power has appealed for an increased output of coal of 250,000 tons a week. That the coal position becomes still more depressing and the outlook for the coming winter still bleaker and graver was made clear by the Minister in a speech during the past week-end. Mr. Shinwell, who certainly made facts known—among them that the Gas Industry has coal stocks to last less than three weeks and that Britain's railways have only 10 days' supply—described the situation as "pretty grim." As far as coal and most other essential commodities are concerned, it can hardly be said that the advent of peace has foreshadowed plenty; hence on all sides further exhortations to tighten our shabby belts with good will and to contemplate with stoic equanimity the utmost economy of all kinds of fuel during the coming winter. Stocks of coal are much lower than they were a year ago—12½ million tons instead of 16½ millions; and in Mr. Shinwell's words: "When the winter comes, unless output is increased, the position will be no better, but in fact worse. We will then have 13½ million tons compared with 18½ millions. . . . For the householder, there will be very little reserve this winter to fall back on." And the Minister went on to refer to street lighting, mentioning that the return to full street lighting cost in round figures one million tons of coal a year, three-quarters of which was "precious gas-coal"; and he added that he could not rob the gas-works stocks in order to keep street lights ablaze everywhere during hours when the majority of people were in bed. It would seem that "early to bed" will prove during the winter months an attractive motto in the interests of personal warmth and also personal safety.

The "GAS JOURNAL" and "GAS SERVICE" will return to London on September 14, from and after which date the Address will once more be the familiar one of long association: No. 11, Bolt Court, Fleet Street, London, E.C. 4. Telephone: Central 2236.

Personal

Mr. H. G. RITCHIE, Engineer and Manager of the Falkirk Gas Department, is retiring on reaching the age limit after just over 25 years' service. Before going to Falkirk he was for four years Engineer, Manager, and Secretary of the Fraserburgh Gas Company, and for eight years Engineer and Manager of the Irvine Gas Company. He was President of the North British Association of Gas Managers in 1931. He is to be succeeded by Mr. W. EWING, who has been Assistant Manager at Falkirk for some years.

* * *

Mr. A. COLLARD is resigning his position of Distribution and Sales Superintendent to the Nottingham Gas Undertaking to take up an appointment in the motor industry at the beginning of September. Mr. Collard received his early training at Rochester, and served as Distribution and Sales Superintendent at Chesterfield, Birkenhead, and Nottingham, the latter for the past 13 years.

* * *

Mr. J. A. HENRY, Technical Assistant and Chemist to the Hinckley Urban District Council Gas Department, has been appointed Assistant Engineer to the Loughborough Corporation Gas Department.

* * *

As a result of recent administrative reorganization in the Ironworks Branch of Newton, Chambers & Co., Ltd., Mr. G. W. ALLOTT, who has been in the service of the Company for over 40 years, latterly as General Sales Manager, becomes Assistant General Manager (Engineering, Sales, and Commerce), Ironworks Branch.

Obituary

The death has occurred of Mr. JOSEPH CLAYTON, Chairman and Managing Director of Messrs. Clayton, Son & Co., Ltd., of Leeds. Mr. Clayton, who had been ill for some months following an operation, died on August 17, in his 75th year. He was educated at Askern College and Leeds University, and in 1885 joined the firm which his father, the late Mr. Laurence Clayton, had founded in 1862. Never seeking the limelight of publicity, Mr. Clayton did a great deal of valuable and unobtrusive work for the British engineering industry. His expert knowledge of gasholder construction and design has long been recognized by the Gas Industry, but his manufacturing interests were wide and varied, and in many branches of engineering he was an authority. During the wars of 1914–18 and 1939–45 many important engines of war, very different from the productions of peace, were made at the Moor End and Pepper Road works of the Company under his supervision. Mr. Clayton was always keenly interested in overseas trade, and he travelled abroad many times in connexion with the contracts undertaken by his firm all over the world. He was also Chairman of Deighton's Patent Flue and Tube Company, Ltd., the Yorkshire Patent Steam Waggon Company, Goodall, Clayton, & Co., Ltd., and Rice & Co., Ltd., in addition to many other engineering interests.

§§

George Dixon

Dr. E. V. Evans, Director and General Manager of the South Metropolitan Gas Company, writes: By the passing of George Dixon there will be great sadness in our Industry.

Behind the charm of his presence lay great technical knowledge and experience, and those of us who sought his guidance left happier and wiser.

We owe to him a great debt of gratitude for the important rôle he played in promoting the usefulness of our national bodies. So often have we availed ourselves of his services in directing and guiding our discussions, and I am one of those in the privileged position of being able to pay special tribute to his work for the Institution and for the Gas Research Board, and to his work on the British Gas Federation Council when that body was engaged in the preparation of its Post-War Planning Report.

In the passing of George Dixon the Industry loses one of its leaders and our Industry can ill spare men of his calibre.

Aug. 25, 1945.

Letters to the Editor

Carbonization Reactions

DEAR SIR,—In replying to Mr. T. B. Smith's letter in your issue of Aug. 15, I will deal first with his final paragraph, because it contains a suggestion of lack of courtesy on my part through failing to mention Dr. A. Jenkner, who collaborated with me in writing "International Coal Carbonization." This charge of lack of acknowledgment, coming from Mr. Smith, seems a trifle odd.

Let me first make it quite clear that Jenkner did not contribute a single sentence to the chapter quoted in my previous letter. The section dealing with central offtakes was based upon an article published in *Colliery Engineering* in October, 1933, the year before the book was published. I later added the numbers of the German patents which the late Heinrich Koppers himself dug up and supplied after reading my article. I may add also that Jenkner contributed less than 20% of the material in the book, of which I am the principal Author.

I did not say that Mr. Smith had claimed priority, but *appeared* to claim priority for the central-offtake suggestion. It is obvious that when he links up in the one sentence his own 1926 suggestion with Carl Still's subsequent application of the principle, one is led to assume that the idea originated with Mr. Smith. That I am not alone in this view is confirmed by the fact that in the current issue of *Coke and Smokeless-Fuel Age*, p. 161, another critic writes as follows:

"The Author (Smith) believes that the method of Carl Still for the withdrawal of volatile oils from the centre of the charge arose from a Paper published by himself in 1926 . . ."

To come now to his first complaint, that I have tried to discredit him by recalling the old controversy on the path of travel of volatiles which he initiated, I consider that when an author attempts to discredit a great Industry in the way he has done, we are entitled to view the picture he presents within a proper background. If we are to be led into a new departure, the Industry would like to be assured that

the leader has established his right to lead. They will want to know what real contribution he has made to the study of the carbonization process. Has he attempted to put us on a false scent before? We must be satisfied that our new leader has a reputation for correctly interpreting experimental results.

That is why I recalled his earlier work. In 1922 he challenged the accepted view that "the distillation products, during the greater part of the carbonization period, leave the charge at the wall face." He maintained that the conditions existing *throughout the carbonizing period* involved the products driven off "in the zones of higher temperature passing to the cooler zones nearer the centre of the charge rather than to an equally hot region above it and along the wall face." He considered that a photograph which he reproduced in *Fuel*, May, 1922, proved "that the generally accepted statement that the volatile hydrocarbons leave the charge nearer the wall face cannot be correct." The photograph proved nothing of the kind, but gave a picture of what took place *only at the end of the process*, when the two plastic layers met.

In that Paper also he described some experiments which he made with blends of coal and coke breeze, omitting to mention that similar work had been done before and published in my Newcastle Paper the previous year. There was no suggestion in his Paper that it was only part of the gas that took an inward and upward path. By 1925, however, he began to wobble, and then said that during the first and second thirds of the coking period (during which time 75% of the gases would have been evolved) the main stream of gas passed inward with an upward tendency, and that during the third period (except for the last hour) the gas passed to the oven wall.

These conclusions were erroneous, and showed that he had not properly grasped what took place in a coke oven, or appreciated the elementary fact that a stream of gas will always take the line of least resistance. Now we find him talking about a "small amount of 'inner passage' hydrocarbons" and a "much larger amount evolved on the hot side of the plastic layer."

Although I was not, according to Mr. Smith, "among the minnows" in 1925, yet I showed in *Colliery Engineering* of May of that year, from a study of the old Appolt oven, that he was in error. I said then: "If Biddulph-Smith's view is correct, then the gases during distillation must pass through the plastic layer and the compact fusion zone, then through the raw coal up through the mass of the charge, and finally through the various layers of coke at the top of the charge—fusion zone, plastic layer, semicoke zone, and coke zone. Is it likely that the gases would take such a path when the line of least resistance is through the coke to the walls up the sides of the retort and away to the ascension pipe? Such a theory appears to us to take for granted that no coking takes place from the top of the charge downwards, but only sides to centre."

It is strange that in spite of my not being among the minnows in 1925, we found Mr. Smith* applying on a works scale in 1930 the breeze-blending process which I had suggested in 1921, again, as far as my recollection goes, without reference to the original Paper from which he borrowed the idea. His theory of the path of travel proved to be a garden path. Will his 80-gallon theory lead us up a path of travail?

Oakfield, The Park,
Cheltenham.
Aug. 21, 1945.

Yours faithfully,
JOHN ROBERTS.

Atomic Energy and the Gas Industry

DEAR SIR,—Although many people may imagine that the Gas Industry can only reconcile itself to the prospect of a slow and lingering death in view of the almost certain eventual harnessing of atomic energy, it would be unwise for the Industry itself to be prematurely alarmed. The Gas Industry has the necessary organization and apparatus installed for efficiently distributing gaseous fuel. The public will continue to need such gaseous fuel for a long time to come, though it may not be produced from coal or coal products in the not so very distant future.

The Gas Industry, through the Gas Research Board, is well advised in its exploration of the possibilities of producing combustible gases, such as hydrogen, methane, ethane, ethylene, &c. It may be that the eventual outcome for the Gas Industry will be the use of hydrogen gas produced from water by electrolysis, and subsequently enriched by the necessary admixture of methane, &c., produced by pyrolysis of petroleum, or by such simple methods as those involving the anaerobic fermentation of vegetable waste products.

Nuclear atomic structure has been a hobby study of mine for nearly 20 years, and I would like to call attention to my publication in *Chemistry and Industry* of June 19, 1943, in which I referred *inter alia* to the nuclear structure of the now famous 235 mass isotope of uranium, which only represents about 0.7% of naturally occurring uranium, but is the real "villain of the piece" as far as atomic fission possibilities are concerned.

31, *Stanhope Gardens,*
South Kensington, S.W. 7.
Aug. 25, 1945.

Yours faithfully,
L. H. SENSICLE.

* *Iron and Coal Trades Review*, Jan. 9, 1931, p. 44.

Changes at Ministry of Fuel

Sir Hubert Houldsworth, K.C., who accepted the position of Controller-General at the Ministry of Fuel and Power for the period of the war at considerable personal sacrifice, has asked to be released from this post, and Mr. Shinwell has reluctantly agreed to his release.

The administrative work at headquarters connected with the coal control will now be in charge of a controller, with the rank of deputy secretary, working under the permanent secretary of the Ministry. Mr. John Innes, who has held executive positions with the Ministry of Fuel and Power since 1942, has been appointed to the post. Sir Charles Reid has been appointed as production and technical adviser, and Mr. J. Armstrong as labour adviser.

Ministry of Works

To facilitate the reorganization of the Ministry of Works consequent upon the alteration in its responsibilities in relation to housing, General Sir Frederick Pile, Bt., G.C.B., D.S.O., M.C., Director-General of the Ministry, has placed his resignation at the disposal of the Minister, who has accepted it.

The Minister has agreed, at the request of Sir Hugh Beaver, Controller-General, Ministry of Works, to release Sir Hugh from his present appointment with effect from the end of September.

Troops to Help Gas-making

The Government have undertaken, as a temporary measure, to lend troops to assist the Gas Light and Coke Company to make gas. The Company states that the return home of many London consumers since VE day, the shortage of domestic coal, and unfavourable weather have led to increased demands on its plant, which its depleted labour force has been unable to meet.

Yorkshire Kitchen Exhibition

The Wath, Bolton, and Thurnscoe Gas Board has just held a very successful kitchen planning exhibition in each of the three townships within its area of supply. For a smaller sized undertaking the effort was highly commendable and aroused great interest, and an astonishing number of orders for appliances were taken in spite of warnings that delivery might be delayed for as long as 12 months. Furthermore the interest shown in gas as a fuel was noteworthy, as some 80% of the people in the area are colliery workers enjoying free "home coal."

Besides a model kitchen with all-gas-heated appliances and expansive cupboard room and floor space, the latest types of cookers, washing machines, and gas fires were on view, including a built-in refrigerator and gas-heated clothes dryer. The kitchen was laid out with all the heating (hot water cylinder, refrigerator, cooker, drying cabinet, and washing machine) on one side, and on the other side the draining board, ironing board, cupboards, &c. The kitchen door opened into a hall, on the opposite side of which were food storage accommodation, and a perambulator and cycle cupboard. Mr. W. Hurrell was in charge of the exhibition, and conducted a series of tours round the kitchen.

Diary

Sept. 6.—Solid Smokeless Fuels Federation: Executive Committee, Gas Industry House, 11 a.m.
Sept. 6.—Industrial Gas Centres Committee: Gas Industry House, 10 a.m.
Sept. 7.—North British Association of Gas Managers: Annual Meeting, Grosvenor Restaurant, Glasgow, 10.30 a.m.
Sept. 10.—Women's Gas Council, Executive Committee: Gas Industry House, 12.45 p.m., to be followed by visit to Watson House.
Sept. 11.—British Gas Council: Gas Industry House, 2.30 p.m.
Sept. 11.—National Federation of Gas Coke Associations: General Committee, Gas Industry House, 10 a.m.
Sept. 11–13.—Association of Public Lighting Engineers: Conference in Glasgow.
Sept. 13.—National Federation of Gas Coke Associations: National Technical Committee, Gas Industry House, 2.30 p.m.
Sept. 13.—Solid Smokeless Fuels Federation: Technical Committee, Gas Industry House, 10.30 a.m.
Sept. 17.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m., Gas Industry House.
Oct. 17.—Eastern Counties Gas Engineers' and Managers' Association: Autumn Meeting, Grosvenor House, Park Lane, W. 1.
Oct. 17.—Institute of Fuel: Royal Geographical Society. Melchett Lecture by Professor C. H. Lander, C.B.E., 6 p.m.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

No. 1

Atomic Energy

[*Specially Contributed*]

The great destruction wrought on two Japanese cities by means of the atomic bomb has naturally excited the liveliest interest in the possible uses of a new form of power. Although the subject of atomic energy has been fairly widely discussed during the last ten or twenty years, particularly as the source of heat of the stars, probably few people outside those actually working on the problem thought that atomic energy would be put to any practical use by man so soon. It is the purpose of this and the following articles to give some account of the source of this energy and of the possible effects of its use, particularly in relation to the Gas Industry.

The Atom

The conception of the atom as an indivisible particle of matter dates back to Roman times, but it was in the nineteenth century that the study of the weight relationships in chemical compounds made the atomic theory extremely useful in the understanding of chemistry. It was found that there were probably 92 different kinds of atoms, known as elements, which could combine with each other in various ways to form chemical compounds. All chemical compounds are composed of atoms, and in theory at any rate can be split up into the component atoms, but the atoms themselves were thought to be indestructible. It is still true that they cannot be split up by ordinary chemical processes.

The discovery of the electron showed that there existed a particle more fundamental than that of the atom, and that the various atoms might themselves be built out of some common substance. The discovery of radioactivity showed that not all the elements were stable, and that some of the heavier ones spontaneously ejected fragments of themselves and turned into other elements. The rate at which this process took place was found to vary very greatly from one element to another, and was unaffected by processes such as heating or chemical combination.

Theory of the Nuclear Atom

By 1920 the work of Rutherford and Bohr had led to the establishment of the theory of the nuclear atom. This postulated a central nucleus containing nearly all the mass of the atom and which was positively charged, surrounded by electrons which moved round the nucleus like planets round the sun. The electron contains the smallest possible charge of negative electricity and has a mass equal to about $\frac{1}{1840}$ that of the hydrogen atom, which is the lightest atom known. Since atoms are electrically neutral the positive charge on the nucleus must be equal to the number of electrons revolving round it.

If the elements were arranged in a series roughly corresponding to an increase in the weights of their atoms, it was found that many of their chemical properties could be explained on the basis of the number and arrangement of the electrons revolving round the nucleus. Any element in this series has one more electron than the one preceding it. Thus hydrogen, the lightest element, has one electron, followed by helium with two, lithium with three, and so on up to uranium, the heaviest known element, which has 92 electrons. The number of positive charges on the nucleus correspondingly increases by one unit for each step in the series, and the numerical position of an element in the series is known as its atomic number.

By considering the energies and relative stabilities of the possible systems of electrons revolving round a nucleus, it was found possible to give a very elegant explanation of many of the facts of chemistry which were already well known. Thus certain elements belong to families the members of which have similar properties, such as the alkali metals, the halogens, and the rare gases. The electronic theory gives a very satisfactory explanation of this, and also of the different kinds of chemical linkages. The wave-length of light emitted or absorbed by the elements can in certain cases be calculated on the basis of the energy change when an electron moves from one orbit to another. The energies involved in re-arranging the electron patterns, detaching electrons from the planetary system, and so on, can be correlated with heats of reaction, electrochemical forces, &c., and there can be little doubt that the ordinary forces of chemical energy are derived from the electrons. The forces liberated in the atomic bomb are of a very much greater intensity than these and are derived not from the electrons but from the nucleus.

The Nucleus

The nucleus is very small, even in relation to the orbits of the electrons. It has a size of about 10^{-12} cm. compared with about 10^{-8} cm. for the diameter of the path of the outer planetary electrons. Since it is unaffected by ordinary chemical reactions it can only be investigated by the use of very elaborate physical methods.

As explained previously, the positive charge on the nucleus is equal to the number of planetary electrons, but it is possible to have nuclei of different weights but with the same positive charge, and hence the same chemical properties. Thus there are two chlorine atoms, one of weight 35 and one of weight 37. Such atoms are known as isotopes, and mixtures of them can only be separated by making use of properties which depend on the mass and not on the chemical properties of the atoms.

Nearly all the weight of the atom is concentrated in the nucleus, and the unit of weight is approximately that of the hydrogen nucleus. The hydrogen nucleus with one positive charge but with no outer electron can exist as a particle, and is known as the proton. Another particle of the same weight but with no charge was discovered by Chadwick in 1932 and is called the neutron. The nuclei of all atoms are now considered to consist of protons and neutrons, the number of protons in the nucleus being equal to the number of planetary electrons. The weights of these particles when packed together are, however, not quite the same as when they are in the free state, and this difference in weight is of great importance as regards the energy that can be derived from the nucleus. It is found that the atomic weights of the elements come out nearest to whole numbers if the weight of the oxygen atom is taken to be 16.000. On this scale the weight of the hydrogen atom is 1.008.

E. H. M, B.

Industrial Electrical Equipment

Simplification and relaxation of the licensing procedure for industrial electrical equipment has been agreed to by the Ministry of Supply. The Control of Industrial Electrical Equipment (No. 4) (Revocation) Order, 1945, has been issued for this purpose. As from Aug. 20 it is no longer necessary for an acquirer to obtain a licence before placing an order for any industrial electrical equipment.

A system of Selective Control, similar to that now applying to metal working machine tools, has been introduced to take care of Service and other essential requirements for certain items where the supply position does not permit of complete relaxation of licensing. These items appear on a Nominated List, and orders for them can only be accepted by suppliers under the authority of a Supply Licence issued by Machine Tool Control, except where the transaction is covered by one of the exemption clauses. The present Nominated List comprises D.C. Motors, D.C. and A.C. generators, static condensers designed for power factor correction, and automatic voltage regulators.

"West's Gas"

With the issue of *West's Gas* for October, 1939, West's Gas Improvement Co., Ltd., suspended publication for the duration of the war for obvious reasons. The taking and publication of photographs of gas-works plant was prohibited, and later the supply of paper was severely restricted. The former of these difficulties is removed, and the Company has been successful in obtaining an allocation of paper.

It is therefore proposed to resume publication in October of this year. The record of the Company's activities, including the erection of several important new carbonizing plant installations, together with the maintenance of existing plant and participation in the manufacture of munitions of war, will certainly be of interest.

The Company anticipates that it will be able to continue with the issue of this publication, which up to October, 1939, had been received with interest over a period of nearly 17 years by many of those associated with the Gas Industry at home and abroad.

Producer Control*

By W. P. SMITH, B.Sc., M.Inst.Gas E.

I FEEL that the economics of the producer plant is a subject which does not receive the consideration it deserves.

The usually accepted text-book figure is that 14 lb. of coke are consumed in the producer per 100 lb. coal carbonized. On this basis and a coal carbonized figure of 44,000 tons per annum, as at Rochdale, with coke at an average price of 50s. 6d., the quantity of coke to producers is approximately 6,000 tons, and its value to-day is £15,150. Thus a saving of only 2% of the fuel to producers—surely not a difficult matter with the institution of careful technical control—would pay the salary of a junior technical assistant spending his whole time on producers alone. And, of course, the higher the market value of coke, the more important this control becomes.

Using 6,000 tons of coke per annum with 88% carbon content, with coke at 50s. 6d. ton av., the annual saving will be £306 for every 1% increase in the CO content of the gas.

The ultimate aim in producer gas practice should be to maintain a constant pressure (Absolute) of producer gas at the retort main CO damper (or in the common CO main) of a constant optimum quality. While even when normally controlled a reasonable measure of success can be obtained as far as constant pressure is concerned, the question of constant optimum quality is more complicated.

It has been shown on many occasions that the quality of the producer gas varies between successive clinkering periods. The CO_2 rises immediately after clinkering, and then settles down rapidly to a steady figure with a tendency to rise when the next clinkering period is due. The effect of this rise in the CO_2 content can be levelled out if several producers are connected to a common CO main supplying the whole bench of retorts.

At Rochdale we have a battery of 5 producers, with 4 producers normally at work, connected to a common CO main, and each producer is divided into four sections by intermediate drip-plate bearers, each section being cleaned in rotation once every eight hours; that is, only $\frac{1}{16}$ of the total grate area is being cleaned at any one time.

The producers are of the closed door type with steam injected air. Additional steam is supplied to the top of the grate, and to the side walls by a series of perforated pipes, and the top plate is not breezed up. The injector steam is supplied through a reducing valve *via* calibrated jets, and the steam pressure to give the required CO main pressure ($\frac{1}{100}$ in. above atmosphere) is adjusted by hand. Given a constant quality and size of fuel, and by having several producers on a common main with a systematic cleaning routine, it should be possible to obtain constant pressure and constant quality.

Fuel.

Constant quality and size of fuel are unfortunately impossible of attainment. The reactivity of the coke also affects the position, and the question arises as to what the technical assistant should do. Is he to work to optimum conditions from day to day, and adjust his retort dampers accordingly, or is he to work at a comfortable steady position on his producers, obtaining a fairly constant producer gas of a quality lower than the optimum, and trust to his producer man to pull him through when he strikes a bad patch of fuel? Or can he compensate in some measure for lack of quality by increased CO main pressure? Constant variation to suit change of fuel will produce the best financial results and give least labour difficulties, and while the second method is usually adopted, the third alternative—namely, working to optimum producer conditions and compensating for variations in quality by adjustment of the main CO pressure—is probably the most satisfactory solution. I think that the reason the second alternative is usually adopted is that in many cases the technical staff has insufficient time to carry out its work.

Plant and Processes Available

Open Front Step Grate Producer with Water Down the Bars.—The only methods of control on this type of producer are by varying the amount of water down the bars, and by adjustments of the main producer damper. The difficulty of getting water uniformly over the producer bars is too well known to need comment. Variations in the atmospheric conditions affect the quality and quantity of the gas made, and for adequate control of the heats constant adjustments are necessary.

Closed Door Producer with Steam Injected Air.—This is the most general type of producer at present in use, and more particularly if breeze burning is to be employed in step-grate producers. Constant CO main pressure can be maintained by variations of the steam pressure to the injector, and the producer is largely independent of atmospheric variations. The quality of the producer gas can be controlled if the steam/air ratio in the injector is low, and if steam can be added independently of the injector and at the same time the limiting conditions of clinker formation can be obtained. The amount of air injected for a given quantity of steam will vary with the resistance of the fuel bed, and only over a limited range will the steam/air ratio remain constant for variations in the load on the producer. The moist steam draws into the injector body air laden with dust which is damped by the steam, and some of it is deposited in the injector duct. This is illustrated by the fact that after cleaning an injector tube the steam pressure required to give the same output from the producer (that is, the same air intake) dropped from 60–40 lb./sq. in., with consequent considerable variation in the steam/air ratio.

At Rochdale the air required is injected according to the usual W.D. practice by pressure steam, while clinker formation at the top plate is controlled by "conditioning" steam from a perforated pipe, and the side wall clinker by steam through perforated pipes fixed inside the producer-plate bearers. In both cases the steam is directed away from the fuel bed so as to minimize the air injector action. While some modifications in the quality of the producer gas are possible by variation of the top and side "conditioning" steam, the main body of the fuel is not affected, and the centre of fire clinker formation is not controlled to any great extent.

To illustrate the value of the closed door principle two analyses are given below, taken as far as possible under identical conditions on a producer just before, and 24 hours after, being converted from open to closed door furnace.

Calculations based on 100 cu.ft. of producer gas at S.T.P.

ANALYSIS 1: OPEN DOOR PRODUCER WITH WATER DOWN THE BARS.

Analysis.	Produced from combustion of lb. C.	Produced from the reaction of lb. H_2O.	Cal. value. Gross.	Cal. value. Net.	Potential heat, B.Th.U. Gross.	Potential heat, B.Th.U. Net.
CO_2 = 5.6	0.174	—	—	—	—	—
CO = 25.0	0.777	—	320	320	8,000	8,000
H_2 = 7.0	—	0.326	320	270	2,240	1,890
N_2 = 62.4	—	—	—	—	—	—
Per 100 cu.ft.: 100.0	0.951	—	—	—	10,240	9890
Per lb. carbon: 105	1.000	—	—	—	10,770	10,400

ANALYSIS 2: CLOSED DOOR PRODUCER STEAM INJECTED AIR.

Analysis.	Produced from combustion of lb. C.	Produced from the reaction of lb. H_2O.	Cal. value. Gross.	Cal. value. Net.	Potential heat, B.Th.U. Gross.	Potential heat, B.Th.U. Net.
CO_2 = 4.2	0.131	—	—	—	—	—
CO = 28.5	0.886	—	320	320	9,120	9,120
H_2 = 13.0	—	0.606	320	270	4,160	3,510
N_2 = 54.3	—	—	—	—	—	—
Per 100 cu.ft.	1.017	0.606	—	—	13,280	12,630
Per lb. carbon	1.000	0.596	—	—	—	12,420
Equivalent heat to— Analysis 1	0.837	0.500	—	—	—	10,400

Thus in Analysis 2 by the combustion of 0.837 lb. of carbon and 0.5 lb. of H_2O we obtain the same potential heat in the gas (10,400 B.Th.U.) which was obtained by the combustion of 1 lb. of carbon in Analysis 1.

In determining the theoretical amount of water vapour required, allowance must be made for undecomposed steam leaving the producer. The dewpoint of the producer gas was found to be 58.7°F., from which .00077 lb. of H_2O is contained in each cu.ft. of producer gas at S.T.P. or $\frac{0.077}{1.017}$ lb. H_2O per lb. of carbon = 0.075 lb. Thus the total steam required in Analysis 2 to give the same heat content of the gas resulting from the combustion of lb. of carbon in Analysis 1 is 0.5 + 0.075 = 0.575 lb. Taking the fixed carbon in the coke as 88%, then the steam required per lb. of coke is $\frac{0.575 \times 88}{100}$ = 0.506 lb.

With the average value of coke at 50s. 6d., and a coke consumption of 6,000 tons per annum, then the relative financial effects of Analysis 1 and Analysis 2 are as follows:

		Per annum.
Analysis 1: $\frac{6,000}{0.837}$ tons of coke consumed = 7,168 tons at 50s. 6d.	=	£18,100
Neglect cost of water		—
		£18,100
Analysis 2: 6,000 tons of coke	= 6,000 at 50/6	= £15,150
$0.506 \times 2,240 \times 6,000$ lb. of steam	= 6,800,000 at 1/8 per 1,000 lb.	= 566
		£15,716

This shows a saving of £2,384 by conversion from the open type to the closed door type of step grate producer.

* From a Paper to the Manchester and District Junior Gas Association.

Step Grate Producer. Blown Air—Live Steam Admitted.—A greater measure of control over producer conditions and the resultant producer gas would be obtained if the air required to produce the necessary quantity of producer gas (and thus the required pressure in the CO main) were supplied by a fan and the main "conditioning" steam supplied independently, the two being adequately mixed before entering the producer—the top and side steam, or local clinker controlling steams being used as at present. Clean air, which can be pre-heated if required, would obviate the present labour on cleaning the venturis, and the steam and air ratio could be maintained at any required amount or varied at will. The actual value of the steam/air ratio could be shown by an indicating thermometer placed in the blast entering the producer. The difficulty experienced in obtaining practically equal work from each of a series of four producers in parallel feeding into a common CO main would be materially reduced. The quantity of air to each producer as shown by a simple orifice meter could be controlled so that all producers do equal work.

There is nothing new in this idea of blown air, as several installations in the country have been fitted with this method of providing the air supply to the producers. It is proposed to adopt this principle at Rochdale, and incorporate certain ideas which we hope will improve the control of the heats on the setting, and keep the producers operating more efficiently.

Step Grate Producer. Blown Air—Exhaust Steam Admitted.—If exhaust steam is available in sufficient quantity at, say, 1½ lb. pressure, then the saving of the steam cost must be added to the other advantages of the process.

Closed Door Step Grate Producer with Auxiliary Gas Firing by the Cracking Process.—This consists in introducing town gas at a point about 2 ft. above the producer door lintel. The coal gas passes through the hot zone of the producer, and the methane and the unsaturated hydrocarbons are broken down to give a larger volume of gas having a lower calorific value. This reaction is endothermic, and thus replaces some of the steam used in the normal process. While tar and ammonia should be removed, this is the only purification necessary. Tests have shown that up to 50% of the thermal requirements for heating the setting can be supplied by this auxiliary coal gas. Above this percentage luminous flames appear in the combustion chambers. Some steam is still required to keep the clinker in the lower portion of the fuel bed under control.

As the auxiliary gas is increased, the producer gas made by the coke is decreased, and unless steps are taken to prevent it, then the surplus heat absorbed by the endothermic gas reaction will become greater than the surplus sensible heat available, and the efficiency of the producer as a whole will fall. To prevent this one or more producers in the battery are shut down, and thus the coke consumed on the remaining producers is increased to restore the heat balance. The process is flexible and the amount of auxiliary gas can be varied at will. The calorific value of the gas leaving the producer is raised when auxiliary coal gas firing is adopted, and these variations are compensated for by varying the pressure in the common CO main. The clinkering position is improved, and it is not necessary to shut off the gas when clinkering the fires. It is, however, necessary to reduce the quantity of gas when producer charging is carried out to reduce waste of gas and to permit the producer man to do his work in safety. In this connexion we find it necessary at Rochdale to reduce the injector steam pressure during the charging operation.

In many types of rotary grate producers, auxiliary charging hoppers are provided to overcome these difficulties, and this practice is adopted in the United States for use with step grate producers.

The producers at Rochdale are fitted up for this auxiliary gas process, and results over a period show that 10 therms of gas are equivalent to 11 therms as coke.

The saving of steam when 15% auxiliary gas firing was used was found to be 30s. per week.

Coal Gas Firing by Direct Addition to the Producer Gas of Coal Gas Diluted with Waste Gas.—Some experiments on the Continent at Grasbrook Gas-Works have been carried out which indicate that under the conditions prevailing, the amount of gas required to replace 1 lb. of coke increased as the proportion of auxiliary gas increased, but apparently no steps were taken to maintain the fuel bed temperature by reducing the number of producers at work. Their next move was to introduce coal gas diluted with an equal volume of waste gas directly into the common CO main. The process presented some practical difficulties, but the results they obtained were slightly better than those when the gas was introduced through the fuel bed of the producer.

The additional thermal efficiency of the plant when all retorts are kept at work (allowing for scurfing) makes the auxiliary gas method worthy of serious consideration, but depends on the coke market. By the use of this method the necessity for putting retorts off towards the end of the week and putting them on again to meet Monday morning's demand can be obviated, and thus a more regular scurfing routine can be maintained. This factor becomes more important when the holder capacity of a works is on the small side.

Closed Door Producer—Breeze Burning.—Breeze burning in the producer has been resorted to in many gas-works, not because breeze is an ideal fuel for producers, but because it is a drug on the coke market. To burn a higher percentage of breeze, fuel below ½ in., it is usual to provide an increase in grate area of 20%. The steam consumption per lb. of carbon is materially increased to overcome the greater resistance of the fuel bed, the clinker difficulties are more pronounced, and the ashpan losses are higher. Despite these drawbacks F. B. Richards has shown a definite financial benefit from this process. The greater clinkering difficulties in everyday working (as distinct from test conditions) will mean that unless a very careful check is constantly kept on the quantity of breeze burned, there is a tendency for the proportion of breeze to be reduced if not eliminated during the night shift.

When discussing breeze burning it should be quite clear that the amount of breeze burning carried out is that due to the breeze added to the run of retort coke, and not the total breeze in the run of retort coke. Since the amount of breeze in run of retort coke may vary fairly considerably, the run of retort coke should first be roughly debreezed, and the required quantity of breeze added back and mixed in.

There are two schools of thought on the subject of breeze burning—one being that all the material below ⅜ in. should be put to the producer (provided the amount below ⅛ in. is not excessive), and the other that the material below either ¼ in. or ½ in. should be discarded. In the latter case this small material has still to be disposed of—now a more difficult matter than before—and in many places a market for the grade ⅛–¼ in. could be found for use in greenhouse stoves, &c.

Briquetting of Breeze

The grade ¾ in. to 0 in. is the ideal size of fuel for briquetting with pitch smalls from the tar plant, which are also rather difficult to dispose of unless burned in the solid fuel boilers. Rochdale has decided to erect a plant for this purpose, as it is anticipated that for several years to come the fuel market will make this process financially attractive. Experiments will be carried out to determine the suitability of these briquettes as a producer fuel, so that an outlet for the fuel will be available if the solid fuel market deteriorates. St. Helens has a plant of this type, but in their case the breeze is ground before briquetting. In the Rochdale plant this grinding is eliminated.

Rochdale producers are designed with 20% extra grate area to allow for either breeze burning or augmentation by producer gas of the total heat in the waste gases entering the waste heat boilers. Our normal procedure is to burn breeze in the winter when the production of breeze is greatest, and when the greatest quantity of waste gases from the setting is available, and to use the augmentation in the summer when the production of breeze is lower and when less steam is available from the waste heat boilers. We have a relatively small standing order for breeze ¾ in. to 0 in. all the year round. The producers are designed to burn up to 50% of breeze below ¾ in., of which not more than 40% is below ¼ in.

Mechanical Producers

The type of external producer with mechanical grate does not seem to have found a great deal of popularity in the Gas Industry, probably due to its higher capital cost and lower hot gas efficiency. Since the producer plant must be 100% reliable, spare plant must be provided which can be rapidly put to work in case of mechanical breakdown. In other industries using producer gas as a fuel, this type of plant is commonly used both in this country and abroad, and it may be that future developments will proceed in this direction largely on account of the low grade fuel which can be used on this type of producer.

Slagging Producers

As one of the limiting factors in producer work both from the point of view of the quantity and the nature of the ash in the fuel is clinker formation, it would seem that a move in the direction of the slagging producer might tend to solve some of the difficulties. This method is used both on the Continent and in America for the production of producer gas from low grade fuel.

In attempting to compare the fuel consumptions at two works, misleading impressions may be formed unless the following factors are taken into account.

Some coals require more heat than others for their carbonization. Durham coals do not compare favourably with some of the Scottish coals in this respect. The size of coal affects the heating, as nut coal requires less heat than slack. A low calorific value town gas requires more heat than a high C.V. gas due to the additional heat required to maintain an efficient water gas reaction.

The load factor on the plant is important since it takes approximately 75% of the heat required for normal carbonization to heat standing retorts. Taken to the limit the lb. of coke per 100 lb. coal carbonized is infinity on a new setting ready to go to work. A figure of 14 lb. of coke per 100 lb. coal carbonized is of little value unless the load factor of the plant is also given.

The nature of the coke must be taken into account, as some cokes in a producer require more frequent clinkering than others. It has been recorded that for some Scottish cokes the producer needs clinkering every 48 hours. The producer gas will be of a more uniform quality with lower average CO_2 content, and the ashpan losses will be less.

While a plea has been made for adequate technical control warranted by the value of the coke to the producers per annum, I would also stress that the producer man should not be picked simply because he is a big hefty fellow, but that this desirable attribute should have common sense. If he uses his brains he can reduce the physical labour, and his available energy can be put to more effective use,

particularly if the going is a bit rough. If he can be persuaded to clean *down* the bars, and free them from ash as his first operation, he can then see what he is doing, and without taking away a lot of good fuel can nearly clean the fire with the hook alone. He will at least be able to move a lot more clinker from both the front and bottom of the fire, and keep the producer back clear, before the fire is dropped or before the fire runs in and renders further work largely ineffective.

As a final plea I would strongly urge that no new plant should be erected without an automatic weigher being incorporated in the supply stream of coke to producers. Without it no accurate costing of retort house working can be obtained, and while the method of counting skips gives a rough guide, it is only rough, and depends too much on the personal element. It is to be hoped that automatic weighing machines will be fitted to many existing settings in the near future.

The closed door step-grate producer with either steam injected air or blown air with injected steam is reliable, thermally efficient, is low in capital cost, and almost fool-proof on moderate efficiencies, but to improve the clinkering troubles future moves may be in the direction of mechanical producers or slagging producers. The blown air method will give a more complete control over producer conditions, and reduce the final cost into holder.

The auxiliary gas firing gives added flexibility, and by working the plant at full output a greater overall thermal efficiency will be obtained, while the cost of fuel to the producer for like conditions shows slightly in favour of the auxiliary gas firing. The final choice is determined by the availability and price of coal, and the return which can be obtained from coke.

DISCUSSION

Mr. **W. T. Hainsworth** (Newton-le-Willows) agreed with Mr. Smith that the producer was a part of the plant which received hard usage in a gas-works. In the past it had been expected to make the gas to heat the settings, and now it was expected to be a boiler plant as well. The process was termed waste-heat recovery, but it was nothing of the sort. It was that part of the plant where they tried to dispose of the breeze and it was the wrong place in which to do so. If it was desired to dispose of the breeze for raising steam, then boilers should be installed to burn it. Stress had been laid on the kind of labour required to clean out the injector tubes. He understood Mr. Smith to suggest that he could save this labour. The difficulty was in cleaning out the settings. What was hoped to be saved in the way of dust in the settings when the producer was blown by air, unless there was some sort of trap in the common CO flue? It was noticeable that Mr. Smith favoured external producers. He had mentioned some of the disadvantages, but apparently had missed the great advantage, which was a clean setting. Anyone who had seen a setting work on external producer gas which had been cleaned was amazed at the quality of the brickwork. It was stated in the Paper that there was a great future possible in the design of external producers. An example could be seen at the Partington Works of the Manchester Corporation, where settings had operated for about 10 years and the condition of the brickwork was very good. Did Mr. Smith's producers have a water feed on the step grate? When a producer was opened it appeared to be very dry. If they were working actually dry, was the wear and tear on the grates any greater than would be the case when working with water?

Mr. **J. A. Speers** (Preston) referred to the step-grate producer with water down the bars. His undertaking had open grates and bars, and although they were subject to the usual fluctuations in quality of gas on the producer cycle, a reasonably good quality producer gas resulted. For a trial they had put doors on three beds and were controlling the primary air. These were the same type of grate, and a good and consistent quality of gas was produced. The producer was below atmospheric pressure. The draught was obtained in the usual manner for open grates, from a chimney or a waste-heat boiler fan, and the top of the setting was under pressure due to gravity. The bottom of the setting was under suction, with level gauge about half-way up the setting, and the whole producer was under suction, which could be controlled by the producer door slides. He had made a note that the average analysis, which he thought would be agreed was satisfactory, was CO_2 5.2%, CO 21.8%, hydrogen 15.4%, nitrogen 57.6%.

Combustion of Coke

Mr. **H. N. Dann** (Blackburn) mentioned a Paper published in *Fuel, Science and Practice* in 1944 by Hiles and Mott on the combustion of coke. From a somewhat extensive discussion of previous published work and their own experimental work, it would seem that the oxygen of an air supply to a bed of coke was virtually used up within half to 9 in. of the point of entry whatever the rate of supply, within a range sufficient to burn coke from 1 to 65 lb. per sq. ft. per hour. They went on to state that the height of the oxidation zone was but little affected by the rate of air supply within the range specified or by the specific reactivity of the fuel, and was determined essentially by the size of the fuel, which seemed to be a very important point to take into consideration.

They further stated that the maximum temperature in the fuel bed occurred at the point of virtual removal of oxygen from the air supply, and depended upon the extent to which predominant CO_2 was accompanied by CO. Their general results were that the first stage of combustion resulted in the production of a gas containing a maximum figure of about 18.5% CO_2, which they never got theoretically, and that subsequently the CO_2 was broken down to CO in the inner portions of the fire bed. The position in the fire of maximum temperature would be affected by the addition of more or less steam, which was important from the point of view of clinker formation. If the point of maximum temperature was to be driven further into the fire, then clinker would be forming further back.

In the Coke Organization's publication on producer gas plant for industrial purposes the point was made that blast saturation temperature should be maintained between 55° and 68°C., but it was pointed out that at a blast temperature above 55° there was a rapid decrease in the amount of steam decomposed, and if the temperature was allowed to exceed 60° there was considerable waste of steam, the gas was wet, and the CO decreased considerably, while a blast saturation temperature of 50° to 55° would give the best furnace gas. The clinkering propensities of many fuels might necessitate higher temperatures, say about 60°. This seemed to be an interesting point in respect of the amount of steam to be admitted to blown air, and possibly it also answered the question of what was the optimum hydrogen content of producer gas.

Mr. Dann thought the use of coal gas in the settings was interesting. It was a process considered theoretically at Stretford many years ago, and provision was made at that time for introducing coal gas directly into the settings. Unfortunately the state of the coke market made it impossible to test the process.

Mr. **R. J. Bradshaw** (St. Helens) remarked that at St. Helens it had been determined not to burn anything below ½ in. All producer fuel was screened and delivered to the producers in graded proportions to accommodate market demands, and this method had been found to be a paying proposition. The very fine breeze was being sold to other fuel users, and there was a possibility of briquetting. It was not only in regard to producer design that great saving could be shown, but also in the setting design. For some years now his undertaking had installed a new type of setting of the balanced-heat type, so that the fuel consumption at present was 11% of the coal carbonized. There did not appear to be really much room for further improvement. He had found that battery producers with a common flue, although a great improvement on unit producers, did not achieve the "steady quality gas on tap" principle; there was still a serious variation of gas quality in the common flue due to fire cleaning which, in turn, affects the heats.

Disposal of Ash

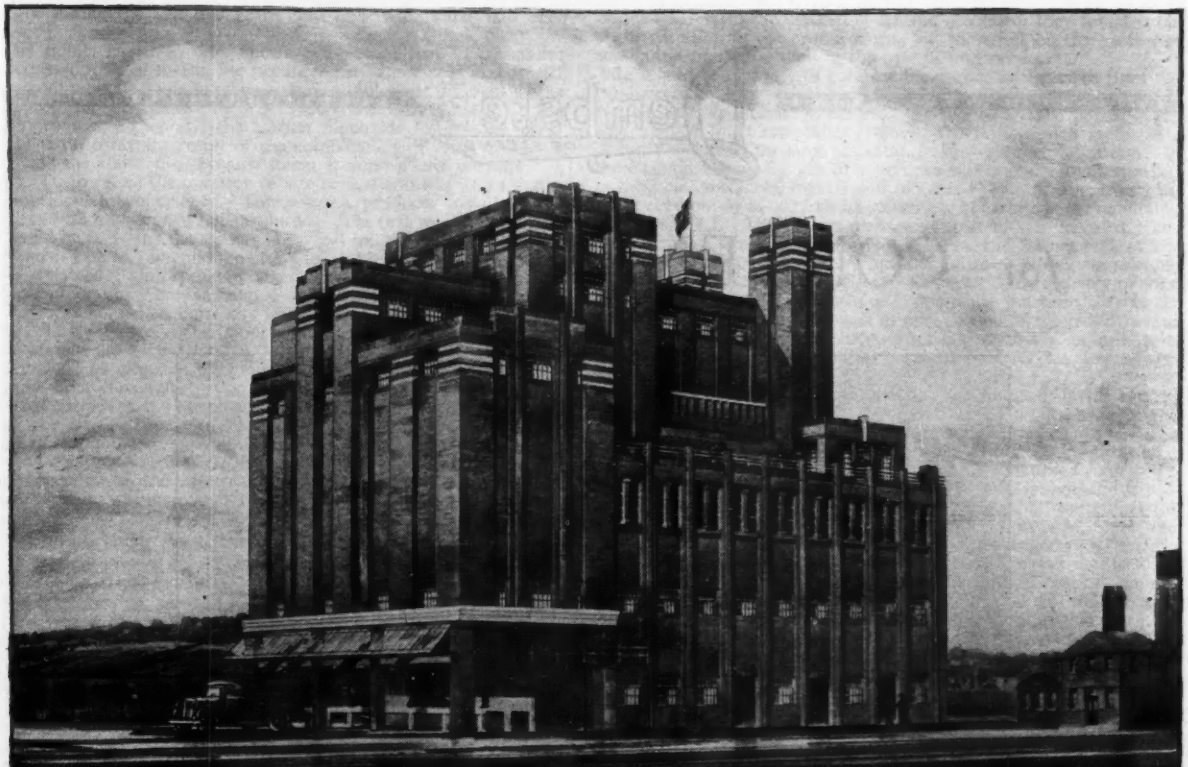
Mr. **Woodcock** (Radcliffe) asked whether the Author recovered combustible matter from the producer ashes and, if so, by what method? Also what was the percentage in the operation?

Mr. **H. Ewings** (Rossendale) asked what was the proportion of ash and dust carried into the retort flues using breeze. With regard to the size of coke put into a producer, he instanced coke used in the Sydney Mines Steel Works. They made producer gas with coke above 1 in., and found that there was an increase in efficiency of 15% considering the clinker formed in the gas producer.

Mr. **H. C. Keywood** (Darwen) enquired whether it was preferable to lead the excess producer gas to the waste-heat boiler direct instead of sending all the producer gas through the setting. There was a weighing machine at his undertaking, but it was found that if the men were not watched they would merely guess a weight. He would suggest to anyone who considered using an automatic weighing machine that they should have a ticket-recording device incorporated in it.

Breeze Burning

Mr. **Smith,** in reply to Mr. Hainsworth, stated that the subject of breeze burning was a thorny one, and from the point of view of producer practice he was of the opinion that it was preferable not to put breeze into the producers. The use of mechanical grates specially designed to burn breeze in the works solid fuel boilers was one solution. It was felt at Rochdale that the use of material below ⅛ in. in the manufacture of pitch breeze briquettes was probably the best solution to this problem. One of the main advantages of the slagging producer lay in its ability to deal with low-grade fuels. The cleaning of the injectors did not involve much trouble and was carried out once a month. It was advisable to re-centre the jets if injector efficiency was to be maintained. Very little dust went forward to the setting, possibly due to the length and diameter of the common CO main allowing for slow travel of the producer gas and acting as a dust collector. It would not appear that with blown air there would be any greater forward velocity of gas than there would be with steam injected air. It was one of the advantages of the external producer that there was clean gas going to the setting, but it must not be overlooked that this was in general accompanied by a lower thermal efficiency. Damage to retort walls by spalling was far more serious than that due to fine dust slagging in the combustion chamber wall. At Rochdale water was not used on the step-grate, and the cost of grate maintenance had been very small. No new grate bars had been



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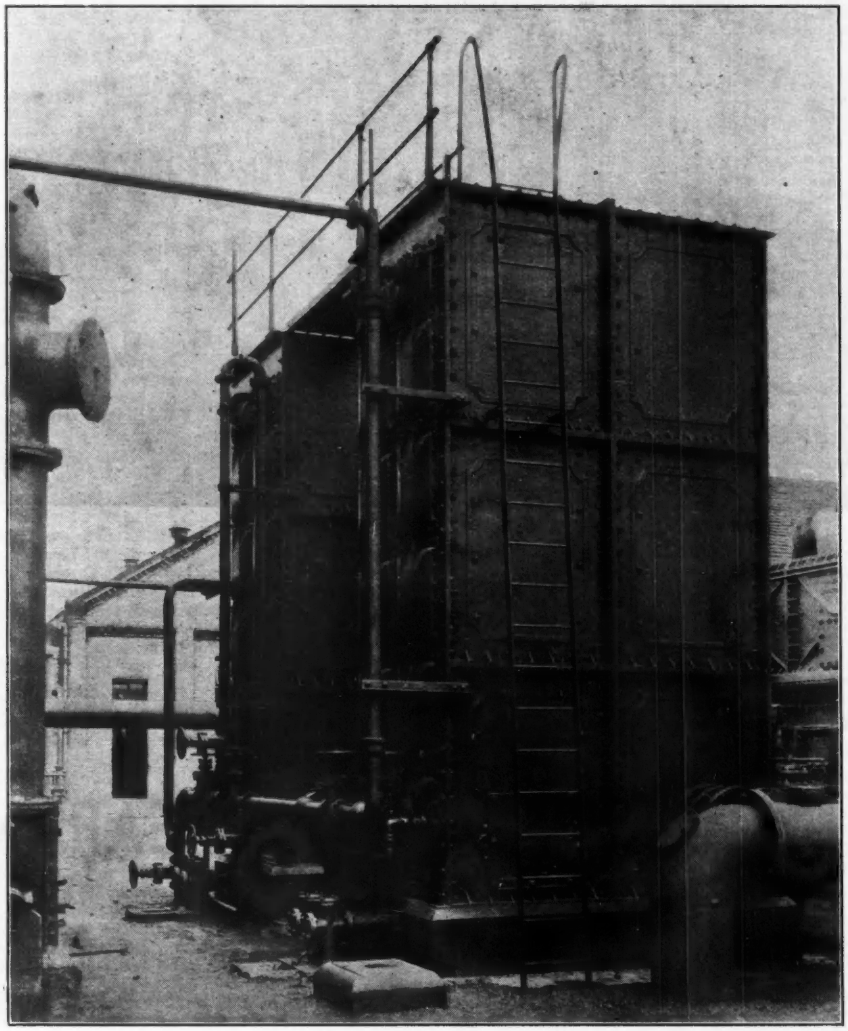

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bought during the last five years, and only one bearer had been replaced.

The points raised by Mr. Speers emphasized that in comparing the consumption of fuel in the producer per ton of coal carbonized, allowance must be made for the varying conditions at different works. The producer gas quoted by Mr. Speers was rather unusual. The hydrogen was higher and the carbon monoxide lower than usual, and was probably the result of the combination of water down the bars and the addition of exhaust steam at atmospheric pressure.

Mr. Dann raised the question of size of fuel and this was a matter of considerable importance. There was a producer installation in Sweden with a battery of five producers. The first was fed with coke graded 2 in. to 1½ in., the second 1½ in. to 1 in., the third 1 in to ¾ in., the fourth ¾ in. to ½ in., and the fifth ½ in. to ¼ in., and excellent results were obtained. Unfortunately there was a hill outside the works composed of coke breeze from ¼ in. to dust. Certain American authorities claimed to burn any size of coke in producers provided it was closely graded. The importance of size of fuel in the domestic grate should not be overlooked, but even greater importance should be attached to closeness of grading.

In general, clinker formation occurred on the side walls, and also as a flat curtain across the face of the producer about 6 in. to 9 in. from the bars. This curtain clinker presumably occurred at the point of maximum temperature—*i.e.*, at the point where the oxygen of the air supply was used up. The distance of this curtain from the bars depended on the steam/air ratio, and increased directly as the steam/air ratio was increased.

Auxiliary Gas Firing

On the question of auxiliary gas firing of the setting, the principal advantage of this method was shown to be during the spring and autumn seasons in an existing setting. In winter all retorts were normally at work, and in summer repairs were usually carried out, reducing the number of retorts available. In spring and autumn all retorts could be kept at work, with the consequent increase in overall thermal efficiency and ease of plant manipulation. In these circumstances the relevant figures were 2.49d. for normal producer gas firing and 2.47d. for auxiliary gas firing. The capital charges involved when building new plant of adequate size for either auxiliary gas firing or coal gas firing rendered the process uneconomical.

Mr. Bradshaw's scheme of screening out all breeze below ½ in. seemed excellent in view of the fact that he had a very good market for the breeze so removed. In Rochdale it was proposed to screen out all fuel below ⅜ in. and use this for the production of pitch/breeze briquettes. With the clinkering scheme described, they found some slight variation in the producer gas, but the effect on the heats was small, and much less than in the case of unit producers.

In regard to recovery of combustible matter in the ashes from the producer, the loss of recoverable coke might be appreciable. If trouble was experienced in the producer due to a patch of dirty fuel, the producer man sometimes removed the bottom step grate plate in order to extract the large pieces of clinker, and then left it out. In these circumstances the loss of good coke was heavy. In a test taken in these circumstances, from 3 tons of ashes 4½ cwt. of coke over 1 in. was picked out by hand, and the percentage of carbon in the remaining ashes was 34.1. The bottom steps were immediately replaced. Dr. Pexton gave a figure of 28% carbon in ashes, and from a bulk of 277 tons of coke he obtained 35 tons of ashes, of which 6 tons was saleable coke, 14 tons dry ashes, and 15 tons of clinker. The recovery of coke by ashpan washers did not seem to be generally practised. Probably the best method of recovery was to employ one of the older men to hand pick the coke from the ashes after first removing the fines by a ¾ in. bar screen. The coke thus regained paid for his wages twice over.

No actual figures were available as to the amount of breeze carried into the retort flues, but this was found to be small owing to the function of the common CO main as a dust-collecting chamber. The fines in the breeze did have the effect of producing a dusty fire, and a proportion often passed through the producer unburned, unless the producer temperature was sufficiently high. Excess moisture in the primary air or down the bars had a tendency to find these fines together on the drip plates, and thus increase the resistance across the grate. The dry fines also tended to form in pockets and thus decrease the effective grate area, causing other portions of the producer to work at an increased rate and resulting in the production of "sticky" clinker.

While agreeing wholeheartedly with the suggestion that the weighing of coke to the producer should be fully automatic and give a printed record, it was open to doubt if the electrical relay controls required would be sufficiently robust to withstand the heavy handling they would probably receive in gas-works practice. The system became more complicated if breeze burning was adopted and the amounts of both coke and breeze were to be recorded. The actual size of the fuel over the range of, say, ¾ in. to 2 in. did not greatly matter. The important factor was the closeness of grading of the fuel supplied to the producer.

Mr. **F. Cartledge** (Oldham) proposed and Mr. E. **Bates** (Manchester) seconded a vote of thanks to the Author, and Mr. **Smith** responded.

Industrial Gas—Future Prospects and Competition*

By L. F. RANDALL,

South Metropolitan Gas Company

ADEQUATE internal organization and industrial sales staff; comprehensive plant installation and maintenance service; constructive price tariffs—these are all required if we are to develop the sale of gas to our industrial consumers to its fullest extent. The question which remains to be considered is: What are the future prospects for this development and what competition are we likely to meet?

Detailed figures are not published which give the quantities of the different fuels used by industry as a whole, but from certain pre-war figures it is possible to estimate approximately that the heat which is required by industry and which is being obtained by the use of solid fuel, oil, and electricity is equivalent to 50 times the quantity of gas which is supplied to industry at present. This figure, of course, must only be considered as an indication of the ratio between the use of gas and other fuels, but it does give an idea of the amount of gas which would have to be supplied if industry took its total heat requirements from the gas-works; and although the picture is an imaginary one, it may help to indicate the extent of the field of opportunity open to us when we consider the future development of gas in this direction.

There is, however, to use the same analogy, a fence dividing our present preserves from this field of opportunity; and the extent to which we can move this fence in order to increase our holding will be dependent to a large degree upon the price at which gas is available locally. There is also a far-distant fence in our imaginary field beyond which are the plants, such as the large steam-raising units, where gas cannot compete unless it can be produced and sold at prices approaching the cost per therm of the heat energy available from raw coal itself.

The area between the two fences is that in which development must in future take place, and is dependent first on the price of gas, and secondly on the efficiency of the industrial sales organization. So the extent of our success will be governed.

Gas has already been used a thousand-and-one ways in industry, and the general development in the future will still be on the already familiar lines, but due to advances in production technique which have been made during the years of war, I think we may expect to see developments equally spectacular when industry reorganizes itself for peacetime production. With this reorganization we shall probably have one of the greatest opportunities for extending the use of gas that has occurred in the lifetime of our Industry. When this time comes we must be prepared for the expansion of our industrial load in the following ways:

1. By the development of the use of gas in the newer industries.
2. By the introduction of mass production methods.
3. By the modernization of pre-war plants.
4. By the improvement of working conditions in factories.

Newer Industries

Among the newer industries one can anticipate the possibility of supplying large quantities of gas to the radio industry for the manufacture and assembly of components and the production of valves; to the plastics industry for the heating of platens either by direct gas heating or by gas-fired high pressure steam boilers and for various curing operations; to the light metals industry for the numerous heat treatment, die-casting, and fabricating processes; and to the welding industry for pre-heating before and stress relieving after welding operations and for the manufacture of the electrodes used for arc welding.

These are only a few examples, and it will be appreciated that with all new industries the sale of our commodity is dependent on the satisfactory application of gas to meet the heat requirements of the processes and upon the expansion of the particular industry itself.

Development of a New Process

When the development of a new process takes place the designers of the plant are generally reluctant to divulge much detail of their requirements, with the result that often the application of heat is not most effectively arranged, and full consideration not always given to the most suitable fuel supply to be used. It is here, of course, that

* Paper to the London and Southern District Junior Gas Association.

the Gas Industry is, to-day, in a much better position to meet requirements of this kind. The wide experience which the manufacturers of industrial appliances have gained, the facilities available at the Industrial Gas Development Centres throughout the country, and the increasing number of undertakings employing specialist staff for industrial development should ensure that, in future, the application of gas to all new processes receives expert attention. Often in the past it has been a question of plant being installed and the heat requirements supplied by another fuel, and then we have had to demonstrate that gas can meet the requirements and give satisfaction from both technical and economic aspects. Even when this has been successfully demonstrated it does not always lead to the installation of gas, as further capital costs would have to be incurred to meet the alterations. There is no doubt that technically the Industry is well equipped to meet all requirements, but it is questionable whether we appreciate always the commercial significance of modern trends of developments. It is therefore essential that our Industrial Sections should keep themselves well posted with all developments in industry, and be ready at all times to undertake investigation into matters which require the application of heat.

Mass Production Methods

To meet the demand for all types of goods which will be required by the home and export markets mass production methods will probably be introduced. In this case the question of timing and handling is an important factor, and no doubt we shall see extensive use made of conveyor type plants; whether these will be moving hearth furnaces, with or without controlled atmospheres, for the various heat treatments of metal, or conveyor type ovens for the lower temperature work, the use of gas should be developed extensively.

All these plants should be fully automatic and equipped with time and temperature controls; and it is here that, although the cost of gas itself will be carefully considered, its adaptability, constant calorific value, freedom from breakdown, and ease of plant maintenance will play an important part. Such systems of production usually have as an integral part competent supervision and cost accounting; both can materially assist in the development of the use of gas because the Production Control will appreciate the advantages of gas as a fuel, and the Cost Control will show all costs in their proper perspective, and will demonstrate that gas as an industrial fuel is worth a reasonably high price per therm. The tendency, therefore, to compare fuels by the prime cost per therm only, which often shows gas at a disadvantage, should diminish.

Infra-Red Heating

The mention of time control calls to notice the use of radiant or "infra-red" heating in connexion with industrial drying and paint-baking processes because, by adopting this method of heating, the considerable reduction in time which is often obtained, and the fact that articles can be processed on a single line conveyor moving at a reasonable speed, lends itself to a simple link-up with a mass production plant.

At the present time most industrial drying and paint-baking processes are carried out in convection ovens employing either natural or forced circulation. For this purpose gas has been found to be a most convenient and adaptable fuel, consequently it has been extensively used. In fact, if a computation is made of the gas used by industrial consumers in convection ovens on any area the figure obtained will usually be far greater than that originally anticipated.

Most of the early installations of ovens specifically designed to employ radiant heat were electrically heated, and due to a considerable amount of electrical publicity there tended to be an impression in industry that electric heating and radiant or "infra-red" heating were synonymous terms. Gas radiant heating units can, however, produce the required results, and it has been found generally that the cost of a gas-fired plant is much less than a comparable electric one, and also that running costs are competitive.

It should be pointed out that experience at the moment indicates that radiant heat has a very important part to play in future mass production developments, but at the same time it is evident that convection ovens will still be used extensively. If, therefore, we are to hold the existing industrial drying and paint-baking load and extend it, our consumers must be made aware of the fact that gas-fired plant can meet their full requirements regardless of the methods they intend to employ.

Modernizing Existing Plants

This section covers a very wide range, as it includes every industrial application which has been made in the past. It is, of course, realized that during the war years plants have been run at high capacity with the minimum of maintenance, with the result that much of the existing plant will require renewal directly the opportunity permits. This refers to appliances operating on all fuels, and if production is to be the key-note of future development, then the important part which the use of gas has played in achieving this same object during the years of war should place the Industry in a favourable position for obtaining a greater share of the business than it has at the moment.

One of the great features about the employment of gas is the simplicity with which the fuel can be used, and because of this our Industry may have been reluctant to complicate appliance design either by the incorporation of automatic control or by paying full regard to appearance.

The cost of gas as an industrial fuel demands that close temperature control should be applied wherever possible, and in addition the incorporation of flame failure safety devices is necessary where it is essential that the method of operating the burner equipment should be absolutely foolproof.

Design of Appliances

The design of gas-fired apparatus has improved tremendously during recent years, and there is no doubt that this progress will be maintained, because the care and attention which is being given to-day to the design and layout of industrial premises will demand that gas apparatus must be in keeping with this trend of events. It may be argued that apparatus will not work any more efficiently if a further sum of money is spent on improving appearance. That may be the point of view taken within our Industry by those who think that an appliance if offered at a low price is the best means of obtaining the business, but this view is not always taken by the consumer, who often is equally impressed by the appearance of the appliance as by its performance.

When considering the question of modernizing pre-war plant it is impossible in the time available to deal comprehensively with the possibilities in all industries, but it may be of general interest to consider the production of foodstuffs, because in the area of every undertaking, whether it be large or small, there is nearly always some installation which is producing foodstuffs for sale. One of the largest sections of this particular industry is the bread, cake and biscuit makers, and for their requirements gas can be used in all types of ovens from the simple conversion of the old-fashioned coal-fired side-flue baking oven to the largest conveyor type plant.

The fuel cost in relation to the "all-in" cost of production is low, as it varies from about 1½% for biscuits to about 5% for bread, assuming present-day costs of manufacture and gas at 10d. per therm. These costs will vary to some degree with the type of plant in use, but they indicate the possibility of demonstrating to consumers the advantages which can be obtained in the factory or bake-house for a relatively low cost when using gas as a fuel. From the gas undertaking's point of view also this business has many attractive features, as it may be considered to be a steady load throughout the year with little, if any, demand for gas on Sunday.

Although reference has been made to one particular section of the foodstuff industry, the fact that the demand for food is a daily one indicates that the demand for fuel in the factories will be similar.

Therefore, when reviewing our future prospects, it is as well to consider the ways and means whereby we can compete with other fuel suppliers for this most attractive load, because there will no doubt be a general desire by the public, at any rate for a time, to demand freshly prepared foodstuffs in preference to canned and substitute foods, and this demand will at once open up the possibility of supplying gas and suitable equipment not only to the large factory, but also to all classes and sizes of businesses. One of the best methods of market research in this connexion is the family shopping basket, because a note of the foodstuffs which are purchased in a cooked state indicates at once where gas can be sold.

Improvement of Working Conditions

The Factories Act of 1937 brought the question of the improvement in working conditions in factories well to the notice of employers, and although during the brief period from the passing of the Act to the outbreak of war the question received considerable attention, the strain of working in factories under wartime comditions demanded that adequate provisions should be made for the welfare of employees. It will therefore be found the principles governing the installation of factory canteens, ablution rooms, and space-heating installations are well established; and a large share of an extension of this business can be obtained by our Industry, if we desire it.

When considering space heating there is a range of gas-fired equipment now available to meet all demands. Mention should, however, be made of the possibility of converting to gas-firing existing solid or liquid fuel fired boilers. High efficiencies can be obtained, particularly if the capacity of the boiler is in excess of the requirements of the installation; and while it is always desirable to install a boiler constructed originally for the use of gas, often the conversion unit makes it possible to obtain the gas load, because it is not necessary for the consumer to meet the expense of replacing an existing boiler which may still be in good condition.

Consideration can also be given to the installation of gas-fired boilers to be used in conjunction with larger heating installations. Frequently it is found that the one boiler installation supplies the major part of its heat for the space-heating requirements and a small part for process work. Instances have occurred where it is more economical to install gas-fired units at the required positions in the factory, so that these can take the process load during the summer months and sometimes during the night shifts, thereby avoiding the running of a large plant and conveying heat often over considerable distances to supply one small section of the factory.

Further development will probably be made in the use of gas-heated radiant heaters for space heating. This appliance has the advantage that it normally requires only a gas supply to serve it, and by the fact that as it is designed to transmit the greatest amount of

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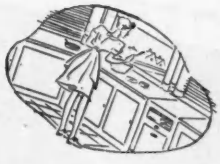

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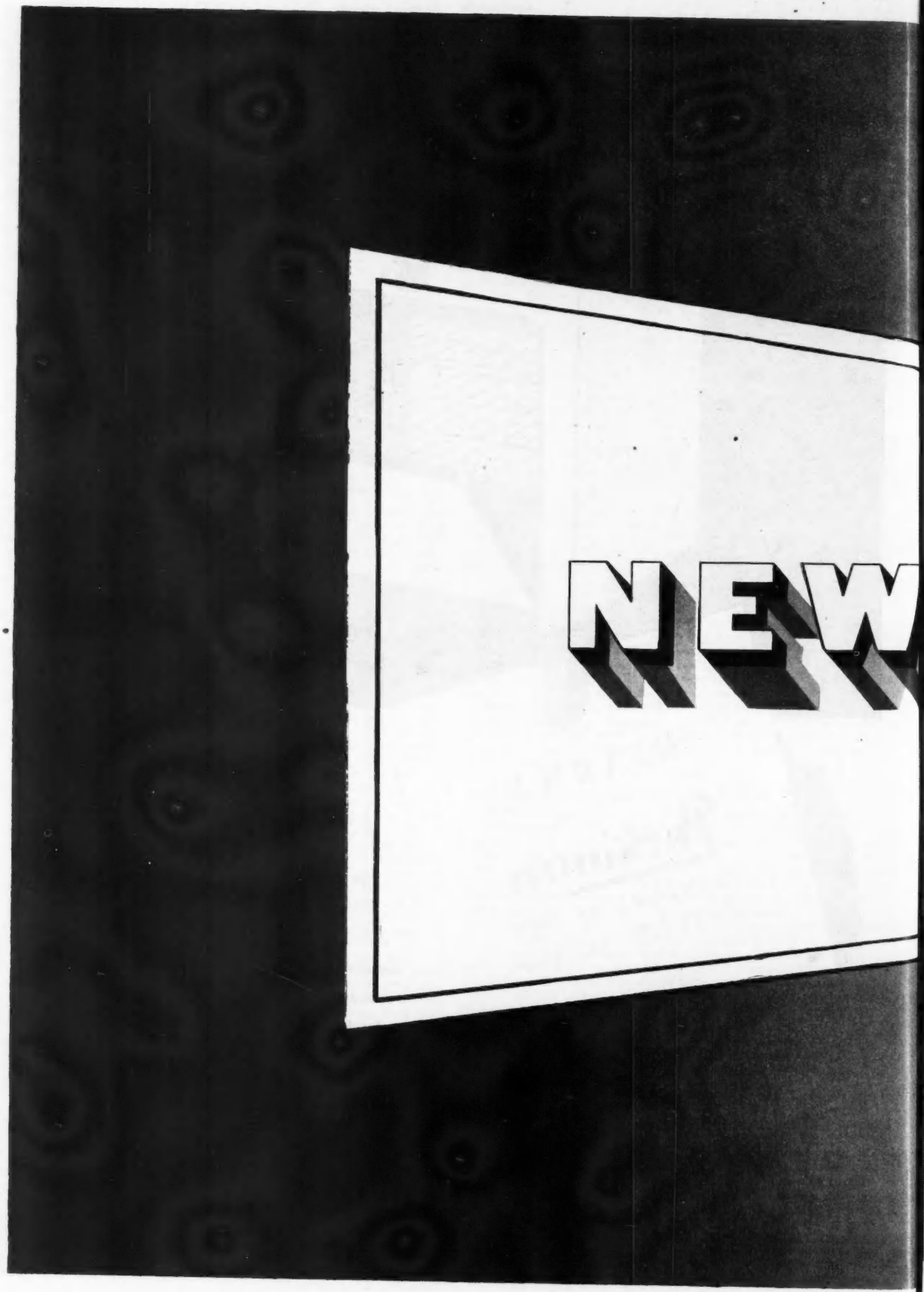
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the heat generated as radiant heat it is possible to direct the heat exactly where it is required, and it is not necessary to heat the whole of an area if only part is being used. Successful installations have been made in factories where, due to the construction of the building, any of the other systems of heating would have been impracticable.

Competing Fuels

The future prices of coal, gas, and electricity and the future position of imported fuel oil are all matters which will affect the issue; it is only possible here to make a few general observations.

In the case of competition from electricity, price is likely to be the most important factor, as both gas and electrical apparatus have very similar advantages in operation. There may be a diminution in the use of electricity for motive power loads in factories, with the result that electric supply undertakings no doubt will increase their efforts to sell current for other industrial uses.

With fuel oil, price again will have considerable effect, but the industrial application of this fuel is, on the whole, more limited to larger installations. Whether the price of fuel oil will be allowed to drop to very low limits, or whether it will be kept to a price comparable with that of other fuels, is a question which cannot, at the moment, be answered. Existing oil installations are generally not difficult to convert to gas-firing, and in cases where the use of oil has involved heavy maintenance costs for plant and refractories, the saving obtained by conversion to gas-firing will help considerably to offset any difference in the cost of fuel.

With solid fuel the size of the installation is usually the factor which determines its selection, and at the same time the possibility of gas being able to compete for the load. In most instances the processes require a very large heat input at a low thermal cost, and thus highly refined fuels are ruled out chiefly on account of cost. There are, of course, instances where gas is being used for such loads, but these usually have some special features which enable gas to be employed successfully.

In cases where the installations are small, gas can compete more favourably, but efforts may be made by the solid fuel interests to extend the use of the smaller types of automatic stoking appliances, which enable solid fuel to be used with better control and with less manual attention.

Pulverized coal, pulverized pitch, and pitch-creosote mixture are fuels which have been used successfully for industrial heat purposes; but in each case there are certain inherent disadvantages which will tend to limit their use.

When, therefore, we take stock of the position, there is no doubt that when Government control is removed competition will be intense, and the future will demand the fullest co-operation of all concerned. Our Industry is fortunate in so far as for more than a quarter of a century it has had experience in developing the use of gas in the industrial market, and this experience is concentrated in a most effective manner in the Industrial Gas Development Centres throughout the country. In addition to our own efforts, which will, of course, be directed mainly to the sales of gas, we also have the help and assistance of the industrial gas appliance manufacturers, who will undoubtedly play an important part in all future developments.

It is also encouraging to note the keen interest which the Technical Press of the Gas Industry has generally displayed in all matters relating to the industrial side of our business; and provided suitable information is made available, the Press can do much to help everybody.

There is a tremendous future in the industrial side of our business, but only the best resources which the Gas Industry has available will be sufficient if we are to realize our ambitions in the field of opportunity which is opening up before us.

Gas Industry's Contribution to Post-War Housing

Written contributions to the discussion on the Paper by L. W. Andrew, E. W. B. Dunning, and G. C. Holliday to The Institution of Gas Engineers. The Paper was published in the "JOURNAL" of June 27, and July 4 and 11.

Mr. **E. W. Atkins** (Bath): While it is clear that an "all-gas" house in which gas is used for all purposes other than lighting and vacuum cleaner points, &c., will give the highest and most labour-saving fuel service, it must be remembered that not only is the average weekly cost throughout the year of 8s. a week in excess of the amount normally allocated in the family budget for this purpose (which would appear to be between 6s. and 6s. 6d. per week), but that the average weekly cost for the winter period for an "all-gas" house is nearly 11s. per week—a figure which for many families would be out of the question. The fact that an "all-gas" house can be run during the summer weeks for as little as 4s. 3d. per week would not, I fear, greatly influence the matter.

Virtues of the Gas-Coke System

It is clear, therefore, that except in exceptional circumstances, it is on the gas-coke combination that the Gas Industry should rely. This combination provides a smokeless labour-saving service of a higher domestic standard than ever before at a reasonable capital cost, and at the least cost to the nation in terms of raw coal consumed. The gas-coke combination gives all these advantages at an average weekly cost throughout the year of 5s. 6d., varying from approximately 7s. in the winter to 3s. 6d. in the summer, which comes within the capabilities of the family budget.

In view, therefore, of the important contribution which coke will make to the post-war housing fuel service, it is to be hoped that even more detailed practical fuel consumption information may be provided by the Authors in the final form in which their Paper is published.

While there are obvious advantages to the housewife in having one solid fuel appliance which will provide both space heating and water heating, it is clear that, quite apart from room over-heating during mild weather in order to provide hot water, there must be some compromises in design of coke-burning appliances which either lead to a general lowering of the efficiency for all purposes, or to the efficiency of either space heating or water heating being maintained at the expense of the efficiency for the secondary use.

It would therefore be helpful if some bench efficiencies and practical coke consumptions for (*a*) coke appliances designed specially for water heating, (*b*) coke appliances designed for space heating, and (*c*) coke appliances designed usually with back boilers to provide both space heating and water heating, could be given, since, if there is a substantial drop in the efficiency of the combined coke units, it would seem that in certain instances it might be advisable to use two separate coke-burning appliances for space-heating and water heating, the space-heating appliance being perhaps so constructed as to include a gas unit for use during mild weather.

Summer Water Heating

The Paper clearly brings home the fact that generally speaking the lowest running costs can be achieved by providing for summer water heating by means of a sink heater and of an instantaneous single-point machine with a swivel spout for the bathroom, with, providing the pipe runs can be kept to a minimum, the installation of the small instantaneous multi-point water heater as a close runner up.

In summing up the general characteristics of gas operated sink heaters the Authors state that storage heaters and instantaneous heaters with open waterways show advantages in maintenance over the more common instantaneous type with closed waterways. It is probably true that the open waterway instantaneous heater shows a small advantage in maintenance, but this is certainly offset in other ways; and in hard water districts it is problematic if the storage heater will show any saving in maintenance. And even if there is a saving, such saving would be more than offset by the additional gas consumption in use, since not only is the storage sink heater not capable of giving the same service as an instantaneous sink heater, but to ensure hot water being available first thing in the morning it would be necessary to leave it on continuously with maintenance consumption of not less than 1 cu.ft. per hour, whereas the instantaneous heater's pilot can be turned off when not in use, and even if left on is less than half the maintenance consumption of the storage type.

It would appear therefore that except in exceptional circumstances it would be an advantage to put forward the instantaneous type of sink heater—a type, incidentally, which our electrical friends cannot offer.

The provision of a flint or other automatic lighter as an integral part of the design of post-war instantaneous sink heaters might be well worth consideration.

Kitchen Ventilation

Mr. **F. J. Brewer**: The subject of ventilation cannot be stressed too much, and the Authors would have done well to have elaborated their few brief remarks on this subject. Those responsible for planning English kitchens seem to have resigned themselves to the almost exclusive use of windows (usually inadequate from all standpoints), and particularly, though not designedly, to doors between the kitchen, sitting, or dining room and the hall for ventilating the kitchen.

With the ever-growing tendency for houses to be designed with kitchens having doors communicating with the hall and the popularity of dining alcoves or dining kitchens, the need for forced ventilation is greater. The effect of the steam and products on the paint-work and built-in equipment, not to mention the excessive heat and kitchen smells, is in itself sufficient to warrant the outlay of a modest sum on an extractor.

Must the modern housewife continue to be baked within her own kitchen; must we have the smells of cooking with us always? Open the outside door and often the gas goes out; open the communicating door and every caller knows the contents of your oven.

The answer is in an extractor fan consuming as little as 25 w. an

hour and moving a volume of air of some 8,000 cu.ft., or approximately some 10 to 12 air changes per hour.

Incidentally, do the Authors really consider 1½ air changes per hour to be an adequate minimum standard of ventilation for a kitchen?

Let us realistically, therefore, examine the kitchen layouts, consider the B.Th.U. output from our cooker oven, boiling rings, &c., and ask ourselves whether this is comfort we offer the housewife.

The Heating Costs

Col. **S. F. Newcombe** (London): In their introduction the Authors give the following capital costs:

(*a*) 5 million houses at £800 each . . .	£4,000 million.
(*b*) Fuel equipment at £50 per house . .	£250 million.
Fuel at 15 to 30 million tons . .	3 to 6 tons per annum.
Present value for 25 years at £3 per ton.	£50
(*c*) Hence, present value of fuel for 5 million houses	£750 to £1,500

To compare the cost of the house, equipment, and fuel, it is essential to give (*c*), the present value of fuel likely to be consumed. The responsibility for ensuring that this fuel is used with economy lies with the Ministry of Fuel and Power—a most important point not yet recognized. It is therefore necessary to discover the heating appliances which will give the required standards of comfort at the least total cost, including the present value of fuel for, say, 25 years.

Seventy per cent. of the population had incomes of only £4 per week pre-war and could only afford about 5s. 6d. per week for fuel. If the problem can be solved for 70% of the population, the wealthier people can add extras to the basic solution. Plan 3 and Plan 1C require 40 cwt. (560 therms) of coke and 265 therms of gas, or 3¾ tons of coal, with an average cost of 5s. 6d. per week. Can savings be effected on these estimates, or can the appliances be improved to reduce fuel without reducing comfort? In Plan 3—

For 30 winter weeks space heating takes 20+15+10 therms of gas .	45 therms.
„ „ „ space heating takes 15 cwt. of coke . .	210 „
„ „ „ water heating takes 25 cwt. of coke . .	350 „
„ „ „ to light the coke takes gas .	10 „
For 22 weeks water and space heating take 5+25+30 therms of gas .	60 „
In the year, cooking, &c., takes 80+50+10+4+15 therms of gas	159 „
	834 therms.

The above estimate is based on "Codes of Functional Requirements," not yet summarized; the air temperature in occupied rooms is to be 60° to 65°F. and "a background temperature of 45° to 50°F. should be maintained, however, throughout the whole house."

These Codes are evidently based on the false premise that heating is continuous. Domestic heating is never, and never can be, needed continuously; it is always needed intermittently, whether for (*a*) cooking, (*b*) hot water for washing and baths, (*c*) for heating rooms as they are occupied. Even if it is convenient to have a boiler continuously alight, its rate of combustion ought to vary with the demand for heat as and when wanted; hence the boiler is used intermittently above its lowest rate of combustion. Intermittent heating requires inner linings of low heat capacity of certain thickness; heat leakage (air to air transmittance) is of less importance. Appliances must be designed for intermittent and not for continuous heating. Thus the walls and ceilings of a house (itself a heating appliance) require damp-proof linings of low heat capacity of 1 in. to 2 in. thickness; similarly, other heating appliances, such as chimneys, ovens, &c., require to be designed to ensure quick change of rate of combustion as well as to avoid heat leakage.

Times of Heat Demand

Probably half the heat is wanted between 5 p.m. and 10 p.m. and *nil* from 10 p.m. to 8 a.m. There should be some data available on this point showing the usual demands for (*a*) cooking, (*b*) water heating, (*c*) space heating, in January, April, and July. Cooking requires only about 8 useful therms per annum, allowing 1 to 10 ratio efficiency for gas and perhaps 1 to 100 for coal. Hot-water efficiency is said to be 25 or 30%, but that is only true for heat transferred to the water, not for hot water used by the person: hence the need to study intermittent heating.

For a room to be comfortably warmed in a short time, the main points are (i) quick rise of temperature of the wall and floor surfaces, (ii) no heat wasted in latent heat, by converting water into vapour (1,070 B.Th.U. per lb. of water at 40°F.), (iii) no draughts, (iv) air temperature. It only takes 18 B.Th.U. to raise the temperature of 1,000 cu.ft. of air by 1°F. Therefore one person at rest emitting 400 B.Th.U. per hour raises the air temperature by 22°F. in an hour in a room 12 ft. by 11 ft. by 7.5 ft.

If the architect ensures that walls and ceilings have damp-proof inner linings of 1 in. or more of Grade A insulation (or even ½ in. fibreboard plus an air space, equalling ¾ in. Grade A), and if draughts are prevented, the room will heat up very rapidly and background heating can be ignored; so can the complicated calculations of heat losses. With 1 in. or more of Grade A insulation ($k = 0.3$) the density will be below 12 lb. per cu.ft. Whether the outer walls be brick, concrete, steel or asbestos cement matters not if this lining be as quoted above.

The first heating appliance, therefore, is the house itself.

Lagging and Thermostatic Control

The coke boiler consumes 560 therms in 30 weeks. If it is to burn continuously, then from 10 p.m. to 8 a.m. it must burn at the lowest possible rate of combustion, say, ¼ lb. or 3,100 B.Th.U. per hour, and from 8 a.m. to 10 p.m., say, 1.6 lb. or 20,000 B.Th.U. per hour, or 25 lb. daily. Now ¼ lb. per hour equals 1 ton per annum and ½ lb. per hour equals 2 tons. The lowest rate of combustion, applied to 5 million houses, is a very important item. With a well-lagged fireplace it is possible to keep the temperature of the fuel above ignition point for several hours after cutting off the draught, having almost no combustion. To have an appliance with a low rate of combustion and quick change for intermittent heating, as is *always* essential for domestic work, the following points are required (and no doubt there are others):

(1) Control of heat, precise air inlet for the required rate of combustion, thermostatic control of the draught, diverting any unwanted heat into an "economizer" or heat storage (70% of American domestic appliances have thermostatic control).

(2) Highly-lagged flues with inner linings of the lowest heat capacity, to enable the draught to be changed quickly; their surfaces heat up in a few minutes instead of hours taken by brick flues.

(3) If only the heat required to cause the draught is allowed up the lagged flue, the control must divert residual heat into water storage. Water has a heat capacity of 62½ B.Th.U. per cu.ft., cast iron, 57, and brick only 22. Water thus holds heat in a lagged tank better than any other material and can distribute the heat as and when required.

(4) Heat leakage is prevented by using the insulating materials of the lowest conductivity and required thickness for a given temperature. Open domestic grates should have light-weight firebacks from 30 to 60 lb. density, not 125 lb., and also be lagged by 2-in. insulation. Domestic boilers should be lagged even more than hot water cisterns. Water in an unlagged tank falls from 140° to 130° in 1 hour, with ½-in. insulation in 4.6 hours, and with 1½-in. insulation in 10 hours. Correct insulation, by preventing heat loss, enables heat to be used at required times many hours later.

A Fallacy

To pretend that air heated by flues in a chimney is usefully employed by convection into another room is a fallacy: it is only useful if wanted at that time and in that quantity in that room—which is most unusual. By storing in water, there are at least 10 hours extra for use. A continuous flow of water into a garden is waste.

With air at 70°F. the loss in B.Th.U. per hour per sq. ft. is as follows:

°C.	Bare surface.	Lagged.	Saved in 1 hr.	Saved in 5,000 hr.
150	167	16	150	7.5 therms.
300	667	46	620	31 „
600	2,650	110	2,540	127 „

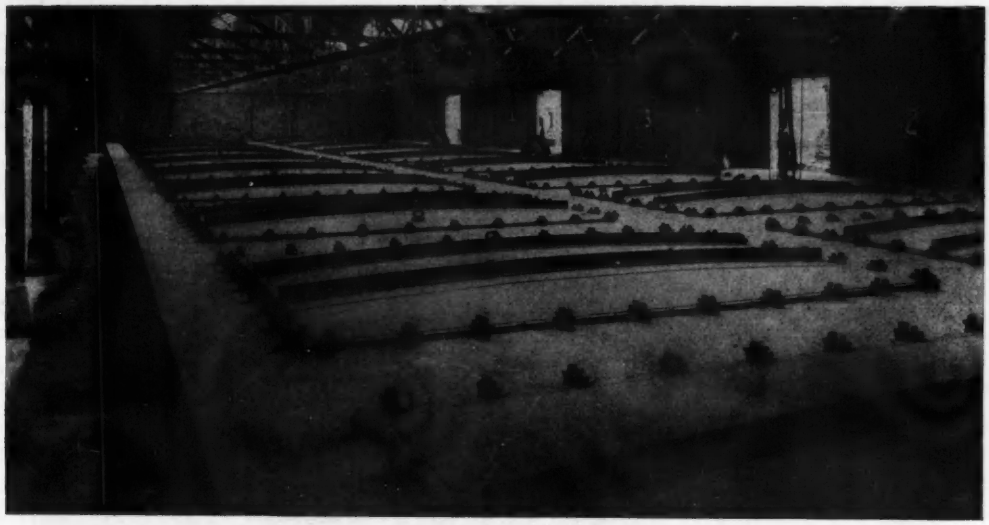
These figures indicate the need to insulate highly the front of a fire (the high temperature), unless it is actually needed to open the fire for radiant heat. There are other items where heat can be saved as advised in the Paper—*e.g.*, by the use of ribbed kettles and by the enclosure, as far as possible, of the hotplate to retain heat or keep off draughts.

If the gas cooker uses 80 therms at 9d., or £3 per annum, the present value of the gas used is £50. Hence the total cost of the cooker is its first cost of £x + 50. Tests should be made on a highly-insulated oven to show if the added cost £y of an improved oven reduces £50 by more than £y. Similarly with other appliances. More tests are required to show their total, as opposed to their first, cost. Highly-lagged ovens save time in heating up, as well as saving fuel.

A therm at 9d. has a present value of 12s. 6d. for 25 years. It is worth while ensuring that the appliances are really efficient, and that the user gets the best possible total value, especially in fuel.

It may be possible to reduce heat for cooking from 80 to 70 therms by means of insulated ovens, &c. But to improve comfort and reduce fuel, the basic requirements of intermittent heating require further study. This includes correct linings of walls and ceilings, damp-proofness, &c. Solid fuel appliances should be designed with thermostatic control, lagged flues, precise air inlets, hot water storage of all waste heat, and the best insulation. One ton of coal per annum per 5 million houses has a present value of £250 million.

One other point to be stressed. People will naturally differ in their needs and uses and also in what they can afford. Before people go into houses with appliances new to them, courses should be held in each locality to show the best way of using the appliances. Complaints can best be prevented by forestalling misuse.



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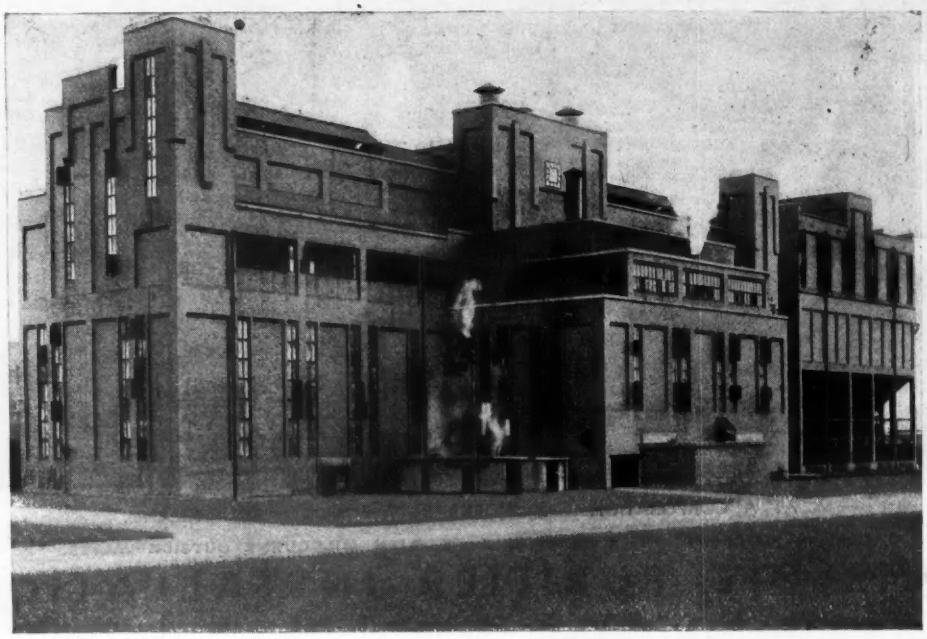

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COMMUNICATION No. 230—PROCEEDINGS OF THE INSTITUTION OF GAS ENGINEERS 1939-40, p. 455.

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Choice of Fuel

Mr. **W. G. Phillips**, jun.: One of the most important points made is that regarding the choice of fuels. There is no doubt that the Gas Industry is about to enter into strong competition from alternative fuels, and every effort must be made to bring to the notice of the local housing authorities, to whom apparently there is at the moment no guidance from official quarters as to the fuels which should be used from the standpoint of individual choice and national economy, that provision should be made for the tenant to have a free choice of fuels, and that after the building has been completed the cost of installation is so many more times the cost had the installation been made as the building went up. Allied to this matter is the vexed question of providing a flue in every room, and this too must be forcibly brought home to the authorities concerned. There is every indication that the electrical industry is bringing forward again as one of the advantages of an all-electric house the saving in capital cost by eliminating duplication of services and the absence of flues.

The Slow Combustion Stove

The Authors mention the openable slow combustion stove giving a high overall efficiency as compared with the open fire. This type of stove has not been used extensively in this country for living room heating, and it will be interesting to know what reception it will be given by the public. I believe this type of heating apparatus was popular on the Continent before the war in countries which experience more intensive winters than those usually met in Britain; yet the fuel used per head of population is lower. It may be that the popularity of this type of high efficiency appliance for heating is partly the answer.

The examples of gas and coke fuel services and estimated consumptions for various plans of dwellings are extremely useful, but it would be an advantage to know the dimensions of the various sections of each house, together with their individual heat requirements. In addition, some figures as to the comparative extra cost in insulation as against the saving in fuel consumption would be of great assistance, as it appears that much greater interest has been aroused in both Government Departments and local authorities in the saving of fuel than was the case prior to the war.

Appendix 3 is probably the most extensive analysis yet made in domestic hot water requirements and gas consumptions to give varying degrees of service, and the overall efficiencies of utilization appear to be lower than were usually taken before the war. However, these consumptions are no doubt taken from actual practical working tests, but the matter is of extreme importance at the present time in view of the large proportion of the total potential gas load taken by water heating.

American Practice

Mr. **R. H. Rowse**: Several contributors to the discussion have referred to American practice. I have recently returned from a visit to the United States and Canada to study the domestic used of fuel, and I should like to comment on some of the remarks which have been made.

Mr. Rayner referred to certain American reservations on ventilation requirements, and quoted a figure of 600 cu.ft. per hour per person as the minimum desirable ventilation. This requirement applies only to public buildings; no such figure is given for domestic dwellings. It is considered that in dwellings the air change provided by adventitious infiltration of air is adequate; open fireplaces are not common and air bricks are not used. The chimney effect of the warm air in the house will be appreciable because of the large differences between indoor and outdoor temperatures, and the air in most of the house is available to the occupants, as American houses are generally built on an open plan with few internal doors and with rooms opening on to one another.

The reason for Yaglou taking body-odour concentration as a criterion for minimum ventilation does not seem to be understood. It was found that in order to reduce air-borne infection to any appreciable extent extremely large air changes would be necessary; these would be difficult if not impossible to obtain in practice, and would make comfort impossible and heating extremely expensive. On reducing the air change it was found that the first observable phenomenon was the presence of body odour. It was found that rates of ventilation sufficiently low to produce an undesirable deficiency of oxygen or concentration of carbon dioxide could be obtained only in sealed chambers, and would not be obtained in normal practice.

It was suggested by one speaker that the convenience of gas accounts for its widespread use in the United States. It is true that Americans attach great importance to convenience, but it should be pointed out that most of the gas used for domestic purposes is natural gas, which is generally considerably cheaper than coal gas in spite of the fact that natural gas may be transported distances of up to and over 1,000 miles. There are wide variations in the prices of fuels throughout the United States, but the following are typical of several large towns in the Eastern States supplied with natural gas:

Solid fuel	$8–14 per short ton (2,000 lb.).
Gas (5 therms per month) . .	20c. per therm.
(100 „ „ „) . .	5c. „ „
Electricity (15 k.w.h. per month) .	4c. „ k.w.h.
„ (250 „ „ „) .	3c. „ „
Fuel oil	10c. per Imperial gallon.

Dr. King has stressed the need for an intensive study of the fundamentals of comfort conditions. There is no question whatever that there is a considerable amount of work to be done in this connexion. A certain amount of work has been done by American physicists and physiologists, who appear to hold the tentative view that comfort is determined by thermal exchange between the body and its surroundings, and that provided the body temperature is maintained within certain limits comfort is irrespective of the proportion of heat lost by radiation and convection; it appears that extremely high or low humidity may cause discomfort, although the limits do not seem to have been determined with any degree of accuracy. At present they have no reason to believe that radiant heating has any physiological advantages.

The Portable Gas Fire

Mr. **H. J. Toogood** (Hampton): Just above Plan 1A appear these words: "A plug point is provided for a gas-poker." Thus, while the gas poker is kindling the coke fire, on many a crisp morning the early breakfast must be suffered in a cold and cheerless dining alcove. Now since 90% of the cost of the gas point is absorbed in the bringing of the gas service to the coke fire, I suggest that all such gas points should have two connectors, so that, at practically no extra capital cost, the users could bring a portable gas fire and have their breakfast in comfort, and throughout the breakfast the busy housewife would have the comforting assurance that the coke fire was being kindled, without waste of time, for the day's particular purpose.

Another point is that bathrooms often have a heated towel rail, yet such an obvious advantage for the small kitchen is conspicuous only by its absence. Hence I suggest there should always be a loop in the hot-water pipe, or its equivalent, so that at practically no cost the kitchen towels are maintained dry and ready for use.

A Perilous War Task

The Co-Partnership Journal of the South Metropolitan Gas Company has fitting reference in the current number to the perilous tasks of the Company's coal vessels during the war plying between home ports. Much of the navigation had to be done in complete darkness except for a carefully screened stern-light, and all instructions were studied and rehearsed before sailing.

"One of the new dangers encountered"—we quote from the article—"was the magnetic mine, but the ingenuity of British scientists devised a system of de-magnetizing ships, which soon made this far less potent than the enemy had hoped. The laying of British minefields right down the East Coast, with a navigable channel through them, did much to prevent the intrusion of marauding submarines; while means of defence, in addition to that afforded by the escort vessels, was in time given to the ships themselves by equipping each with several guns manned by trained gunners, a kite balloon, and rockets. A number of the Company's seamen, and volunteers from co-partners ashore, were given a special gunnery course, and manned the guns when the necessity arose; in addition, two or three naval or army gunners were added to the complement of each ship.

"In spite of these defence measures, however, the voyage remained full of risk and the Company's fleet of vessels was reduced by over 50%, four ships being lost out of seven. The vessels lost in the common cause were:

S.S. 'Brixton'—Sunk by mine, Aug. 15, 1940.
S.S. 'Old Charlton'—Dive-bombed and sunk, Feb. 27, 1941.
S.S. 'Effra'—Torpedoed by an 'E' boat and sunk, April 17, 1941.
S.S. 'Catford'—Sunk by mine May 31, 1943.

"The defensive equipment of the ships was gradually increased as the tactics of the enemy changed, and as the necessary weapons became available. In the early days a 12-pounder high and low angle gun firing six shells a minute was fitted in the stern, necessitating the strengthening of the deck, and a Lewis machine gun on the boat-deck; later twin Marlin machine guns were mounted on each wing of the bridge, which was reconstructed to take the steel and plastic armament of the gun-nests. The Lewis and 12-pounder guns were later replaced by Oerlikon cannon firing 250 to 300 shells a minute, and further improvements were made in the armament on the bridge. The vessels were also equipped with a kite balloon, with a ceiling of 1,000 feet, fitted to the mainmast and operated by a deck winch. On each side of the wheelhouse were fitted two rockets, the four being fired simultaneously by pulling a wire. The rockets rose to a height of about 600 feet and then opened out with a parachute at the end of 60 feet of wire, which floated down very slowly. Thus, when occasion demanded, these ships were able to give a good account of themselves, and the Hun found that attacking a convoy of ships so equipped was no joy ride, whether he attempted it by air, by submarine, or by E-boat."

The Metropolitan Gas Company of Melbourne reports by cablegram to William Coward & Co., Ltd., a net profit for the year ended June 30 of £173,304; transfer, £15,000; final dividend of 5s. per share, and carry-forward £96,131.

GAS PRODUCTS PRICES—STOCKS AND SHARES

The London Market Aug. 27.

The prices of Coal Tar Products are unchanged.

As from March 5, by the Coal Tar Products Prices Order, 1945 (S. R. & O. 1945, No. 229), the maximum price of Pitch for briquetting has been increased to 60s. per ton f.o.r. supplying works, and the prices for Road Tar, as fixed by the Coal Tar Products Prices Order, 1943, S. R. & O. No. 1528, have been increased by one half-penny per gallon. There is also an increase of 5s. per ton in the price of standard Creosote/Pitch Mixture.

The Government Order of June 11 increased the prices of Coal Tar Spirits. This Order is entitled the Control of Benzole and Coal Spirit Order, 1945 (S. R. & O. 1945, No. 681).

Control of Toluene (No. 4) Order, 1944 (S. R. & O. 1944, No. 170), contains an amendment of the Control of Toluene (No. 3) Order, 1943.

Coal Tar Products Prices (No. 2) Order, 1944 (S. R. & O., 1944, No. 1051), allows increases in the maximum prices for all forms of Naphthalene.

The Provinces Aug. 27.

The average prices of gas-works products during the week were : Pitch and Crude Tar,* Toluole, naked, North, 90's. 2s. 4d. to 2s. 6¾d., pure, 3s. 2¼d. (now controlled by S. R. & O. 1945, No. 681), operative from June 11, 1945. Benzole and Coal Spirit, also Coal Tar Naphtha and Xylole, are now controlled by the Control of Benzole and Coal Spirit Order, 1945, dated June 1, 1945, S. R. & O. 1945, No. 681, operative from June 11, 1945. Carbolic acid, 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil controlled by the Coal Tar Products Prices Order, 1943, dated Oct. 20, 1943 (S. R. & O. 1943, No. 1528), operative from Nov. 15, 1943, Naphthalene now controlled under S. R. & O. 1944, No. 1051, operative from Sept. 22, 1944.

Attention is called to Coal Tar Products Prices Order, 1945 (S. R. & O. 1945, No. 229), referred to on p. 305, "JOURNAL" of March 7.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Scotland Aug. 25.

Market is quiet, with prices steady. Refined tar* : Yield to Distillers is 5d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5¼d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7½d. to 7½d.; benzole absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha† : 7d. to 8d. per gallon. Solvent naphtha* : Basic prices delivered in bulk, 90/160 grade, 2s. 10d., and 90/190 Heavy naphtha, Unrectified, 2s. 0½d.; Rectified, 2s. 4d. per gallon. Pyridine† : 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

There was a certain amount of "making good" of previous reactions during last week, and although the volume of business was only on a moderate scale, there were confident hopes of further improvements.

The Gas Market remained irregular with the majority of movements downwards. There were two special features, however—*viz.*, a rise of 12 points in Montevideo stock to 112½ and, in the Supplementary List, Hampton Court consolidated stock, in which business was recorded up to 118, closed 14 points higher at 116½.

The following is the full list of price changes last week :

SUPPLEMENTARY LIST

Brighton 5 p.c. Deb.	122—127	—1
Cheltenham Cons. (*x.d.*)	108—113	Aug. 20
Croydon 4 p.c. Pref. (*x.d.*)	98—103	,,
Hampton Court Cons.	114—119	+14
Uxbridge 5 p.c. Deb.	122—127	—1

PROVINCIAL EXCHANGES

Blyth Ord. (*x.d.*)	124—126	Aug. 20
Newcastle Units	23/9—24/9	—1/3d.
Preston "A" (*x.d.*)	185—190	Aug. 13
,, "B" (*x.d.*)	140—145	,,

OFFICIAL LIST

Associated Gas & Water Undertakings Ord.	22/6—23/6	—/6d.
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Barnet Ord. (*x.d.*)	159—164	Aug. 20
Croydon Sliding Scale (*x.d.*)	122—127	,,
Ditto max. div. (*x.d.*)	104—109	,,
East Surrey 5 p.c. Deb.	122—127	—2
Gas Light 4 p.c. Pref.	101—104	+1
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Ditto 4½ p.c. Red. Cum. Pref.	21/3—22/3	—/6d.
South Metropolitan Ord. (*x.d.*)	89—92	Aug. 20
Ditto 6 p.c. Pref. (*x.d.*)	126—131	,,
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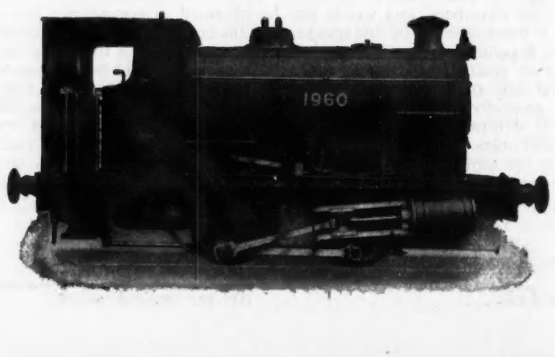

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OWING to the closing down of the Works at Marlborough, Hungerford and Lambourn about the end of October, there will be available for sale a certain amount of plant. Inspection is invited, and details will be supplied upon application to: The General Manager, Swindon United Gas Company, 43, Regent Street, Swindon.

QUANTITY of horizontal retort bench iron work available. Please apply to the Manager, Brixham Gas and Electricity Company, Fore Street, Brixham.

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CLOCKWORK Controllers for Public Lighting Control and Time Switches, Clocks and all type of instruments and appliances operated by Clockwork Repaired, Overhauled and Guaranteed. Inquiries welcomed. J. W. & R. E. Hughes (Clockwork Engineers), 58, Victoria Street, London, S.W. 1. ('Phone Victoria 0134.)

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WANTED.—Complete volumes of the "Gas Journal" for the years 1938–1944 inclusive. Alternatively years 1938 and 1939 only. Offers to No. 9465, "Gas Journal," 51, High Street, Esher, Surrey.

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COMPANY NOTICE

THE GAS LIGHT AND COKE COMPANY

3½% Redeemable Debenture Stock, 1956

NOTICE IS HEREBY GIVEN that the TRANSFER BOOKS of this Company, so far as they relate to the above-mentioned Debenture Stock, WILL BE CLOSED at 4 o'clock p.m. on the 10th September, 1945, for the half-year ending on the 30th September, 1945, and will be REOPENED on the morning of the 11th September, 1945.

Chief Office : By Order,
30, Kensington Church Street, Brian Wood,
W.8. Secretary.
August 10, 1945.

CONTRACTS OPEN

BOROUGH OF KEIGHLEY

(Gas Department)

TENDERS are invited for the Supply and Delivery of OXIDE OF IRON and the Purchase of SPENT OXIDE during the Twelve months commencing October 1, 1945.

Specification, and Form of Tender, may be obtained from F. N. Booth, Gas Engineer and Manager, Corporation Gas Department, Cook Lane, Keighley.

Tenders in plain sealed envelopes, endorsed "Oxide of Iron," to be received by me not later than September 13, 1945.

Town Hall, S. Walker,
Keighley. Town Clerk.

APPOINTMENTS WANTED

ACCOUNTS CONTROLLER, aged 40, requires change with improved prospects. Office Manager, &c. Capable. Over 20 years' experience in Gas Industry. Address No. 9463, "Gas Journal," 51, High Street, Esher, Surrey.

APPOINTMENTS VACANT

None of the situations advertised in these columns relates to a man between the ages of 18 and 50 inclusive or a woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.

A PROGRESSIVE small Undertaking (40 millions) in Devon invite applications for the following:

(*a*) Experienced all-round GAS FITTER. Wages 1s. 8½d. per hour.

(*b*) IMPROVER (District trained). Wages 1s. 5½d. per hour.

Applications should give details of Training, Experience and Examinations passed. Testimonials are not required in the first instance. Address, No. 9466, "Gas Journal," 51, High Street, Esher, Surrey.

APPLICATIONS are invited for Positions on the TECHNICAL STAFF of a large gas undertaking in the Greater London area. Qualified and experienced chemists, not less than 25 years of age, with knowledge of the control of gas manufacturing and purification plant. Salaries will be in accordance with the qualifications in each case, but will be not less than £400 per annum. Applicants should state their Training, Experience and Qualifications. Applications must be received not later than Saturday, September 8, 1945. Address No. 9464, "Gas Journal," 51, High Street, Esher, Surrey.

DRAUGHTSMEN.—London Firm of Carbonizing Engineers require mechanical and structural DRAUGHTSMEN with experience of Continuous Vertical Retorts and Intermittent Chambers. Must be capable of working with minimum supervision. Five-day week. Applications, which will be treated in strict confidence, giving full particulars of experience, with salary required, to be addressed to No. 9459, "Gas Journal," 51, High Street, Esher, Surrey.

REQUIRED.—MAINTENANCE FITTER with Gas-Works experience, preferably with horizontal plants on small works. Single man preferred, able to drive. Apply: Severn Valley Gas Corporation, Gas-Works, Cheltenham.

SENIOR DRAUGHTSMAN required, experienced in design of Carbonizing Plant and Structural Work, also capable of taking out quantities and preparing specifications.

Reply, stating Age, Experience and Salary required, to F. C. Sugden & Co., Ltd., 10, East Parade, Leeds, 1.

ENGINEERING DRAUGHTSMAN required. Salary according to qualifications, with minimum of £400 per annum, inclusive of war bonus. Applications giving full particulars of Age, Training, Experience and Technical Qualifications, and stating position under National Service Acts and Essential Works (General Provisions) Order, to be addressed to: General Manager, Bristol Gas Company, Radiant House, Bristol, 1.

BINGLEY URBAN DISTRICT COUNCIL

(Gas Department)

WORKING FOREMAN wanted. Must be used to Vertical Retorts, with a good mechanical knowledge and experience, and used to the control of men. Salary £275 per annum, plus War Bonus, at present £59 per annum. The post is designated under the Superannuation Scheme, and the successful candidate will have to pass a Medical Examination.

Applications, stating Age, Present Position, Experience, married or single, and whether now engaged under the Essential Works Order, together with *copies* of three Testimonials (including a recent one from present employer), to be sent in not later than 12 noon, September 10, 1945, addressed to: F. M. Dunwell, Clerk to the Council, Myrtle Grove, Bingley, endorsed "Gas-works Foreman."

ENGINEERING ASSISTANTS

TWO Engineering Assistants are required, with drawing office experience. One of the Assistants to have specialized knowledge of the manufacture and design of coal and coke handling plant, and the other specialized knowledge of vertical and horizontal carbonizing plants. Applicants should give particulars relative to Age, Salary required, academic qualifications, workshop experience and positions held. Applications to be addressed to the United Kingdom Gas Corporation, Limited, Swettenham Hall, Swettenham, near Congleton, Cheshire, and endorsed "Engineering Assistant."

THE CROYDON GAS COMPANY

GENERAL MANAGER

APPLICATIONS are invited for the Position of GENERAL MANAGER of the above Company. Commercial and administrative experience essential, and knowledge of the Gas Industry an added qualification. Age about 45. Minimum Salary £2,100, plus a temporary War Bonus of approximately £150; co-partnership; bonus in addition and Contributory Pension Scheme, subject to passing medical examination. Effective date for engagement can be arranged. Applications with *copies* of three Testimonials to be addressed to the Chairman at Gas Company's Office, Katharine Street, Croydon, not later than October 15, 1945.

VITREOUS Enameller; charge hand wanted by Manufacturers of Domestic Appliances in Liverpool Area for the Enamelling Department. Good prospects and permanent position for suitable and experienced applicant. Write, giving full particulars, to No. 9467, "Gas Journal," 51, High Street, Esher, Surrey.

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WORKS SUPERINTENDENT

APPLICATIONS are invited for the above Position at a salary (inclusive of War Bonus) of £300 per annum, with free house situated at the Company's Works.

Applicants must have sound practical experience in the control of Vertical Retort Plant, the operation and maintenance of all Gas Works plant (including mechanical and electrically operated plant), and be able to control labour. The successful candidate will be required to take full charge of the Works in the absence of the Engineer and Manager.

Applications, stating Age, Experience, &c., together with *copies* of not more than three Testimonials, and position in relation to Essential Works Order, to be addressed to the undersigned not later than September 7, 1945, endorsed "Gas Works Superintendent."

Bank Street, Galashiels. John Chapman,
August 22, 1945. Secretary.

GALASHIELS GAS COMPANY, LIMITED

TECHNICAL ASSISTANT required, having experience of Vertical Retort Plant and capable of undertaking routine works testing. Applications, stating Age, Experience, &c., salary required, and position under Essential Works Order, endorsed "Technical Assistant," to be delivered not later than September 7, 1945.

Gas-Works, Wm. C. Campbell,
Galashiels. Engineer and Manager.

COUNTY BOROUGH OF SOUTHPORT

(Gas Department)

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THE Council invite applications for the temporary position of DISTRIBUTION SUPERINTENDENT at a commencing Salary of £360 per annum, rising by annual increments of £15 to a maximum of £405 per annum, plus the appropriate cost of living bonus.

Applicants must have a sound technical and practical training in all branches of distribution work, and must be experienced in the control of workmen.

The appointment will be determinable by either side on one month's notice, and will be subject to the provisions of the Local Government Superannuation Act, 1937. The selected candidate will be required to pass a medical examination.

Applications, stating Age, Qualifications, present appointment and duties, and full details of Experience, accompanied by *copies* of not more than three recent Testimonials, must be delivered to the undersigned, endorsed "Distribution Superintendent," not later than September 12, 1945.

Canvassing, directly or indirectly, will entail disqualification.

Town Hall, Southport. R. Edgar Perrins,
August 24, 1945. Town Clerk.

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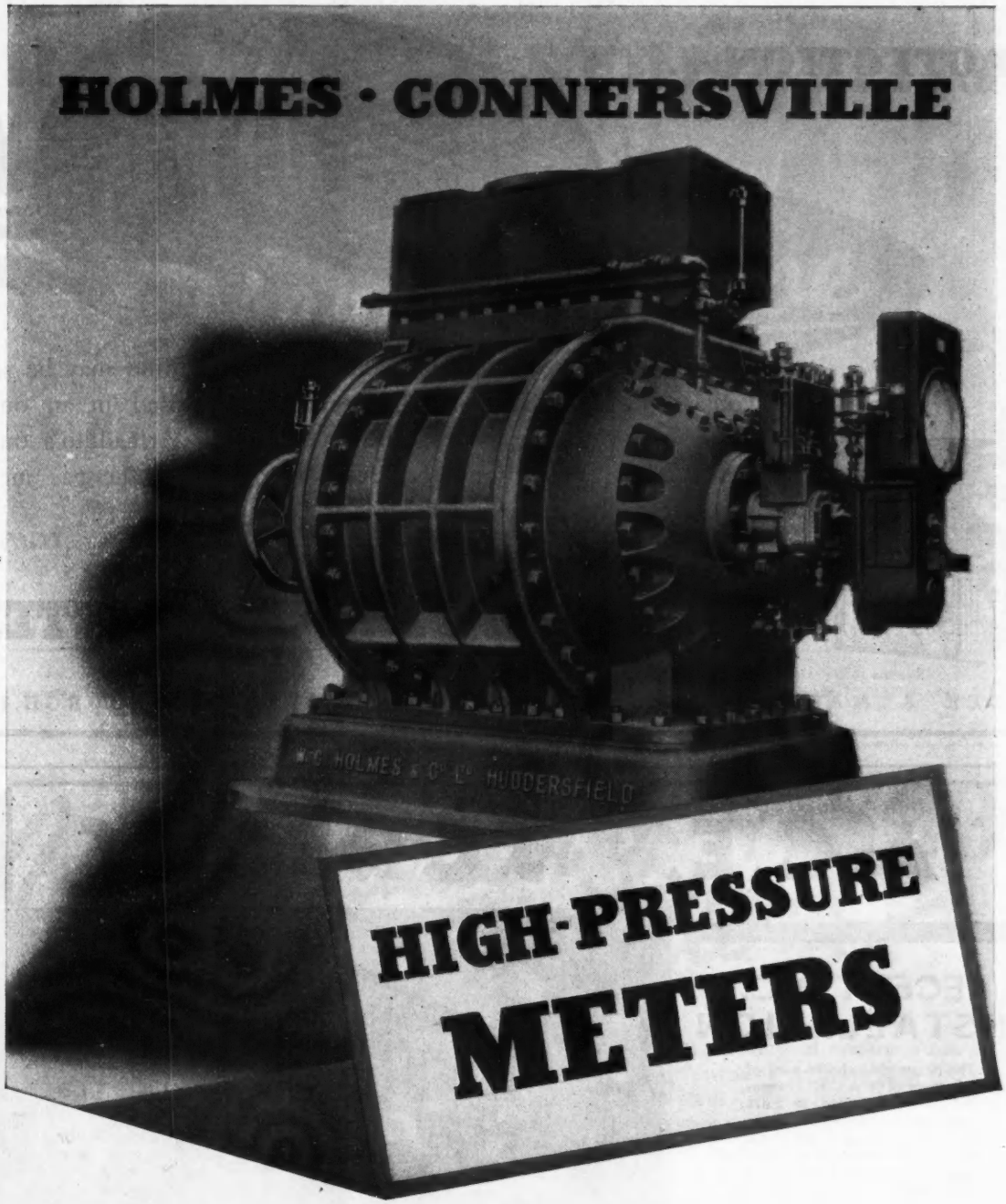

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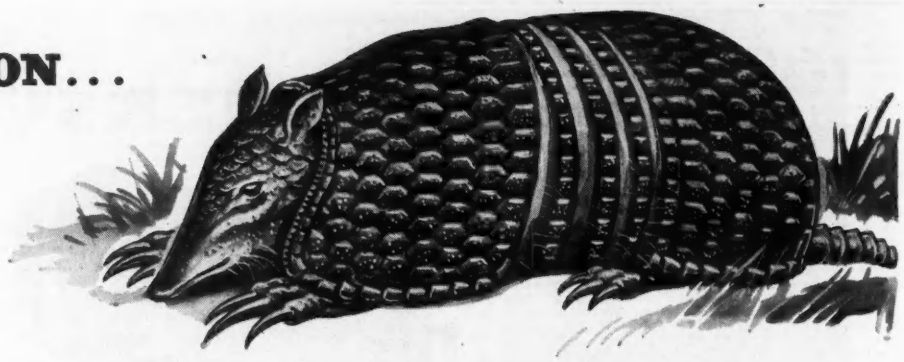

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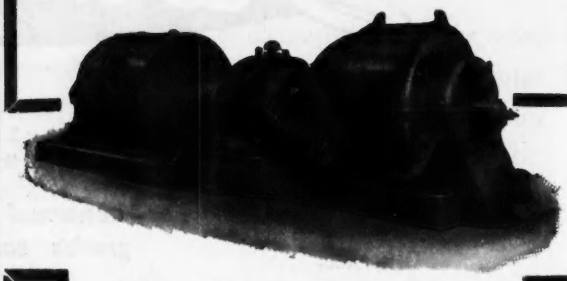

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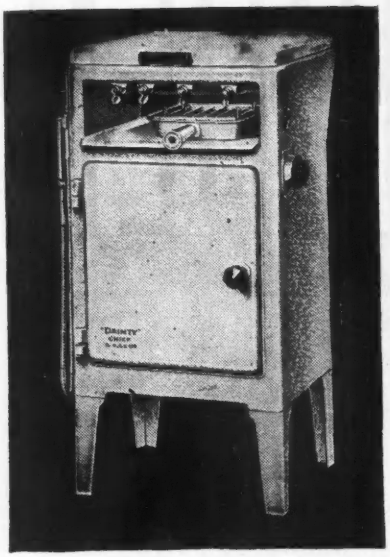

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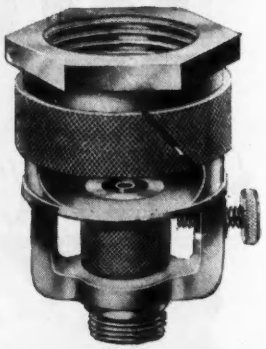

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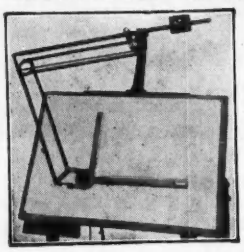

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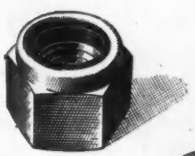

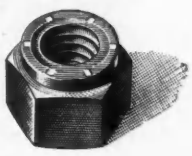

SIMMONDS STOP NUTS

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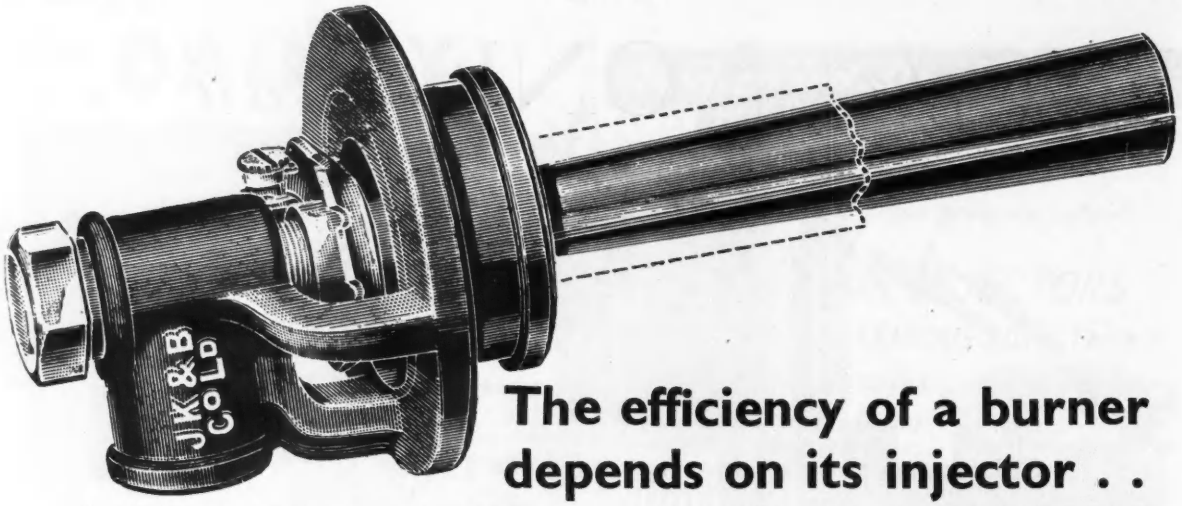

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PUMPS

FOR GAS WORKS

Fig. 705. "SINGLE-RAM" STEAM-PUMP.

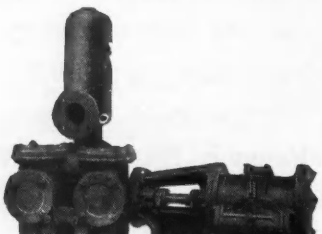

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

TRADE MARK LION

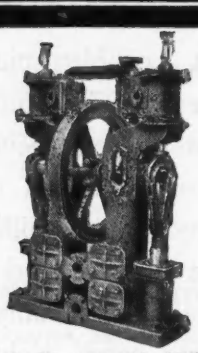

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

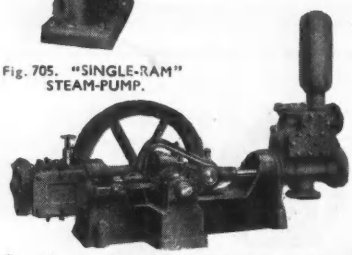

Fig. 680. "RELIABLE" PUMPING ENGINE FOR THIN TAR, AMMONIACAL LIQUOR, BENZOLE LIGHT OILS AND WATER.

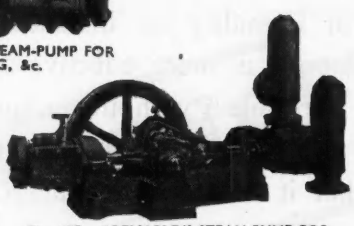

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND ALL THICK FLUIDS.

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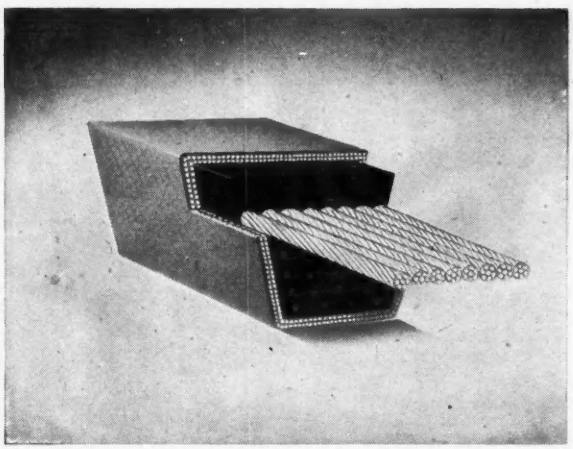

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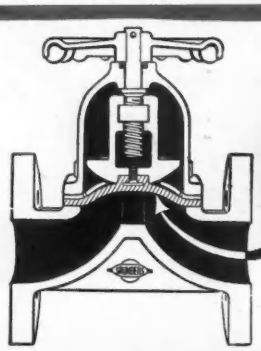

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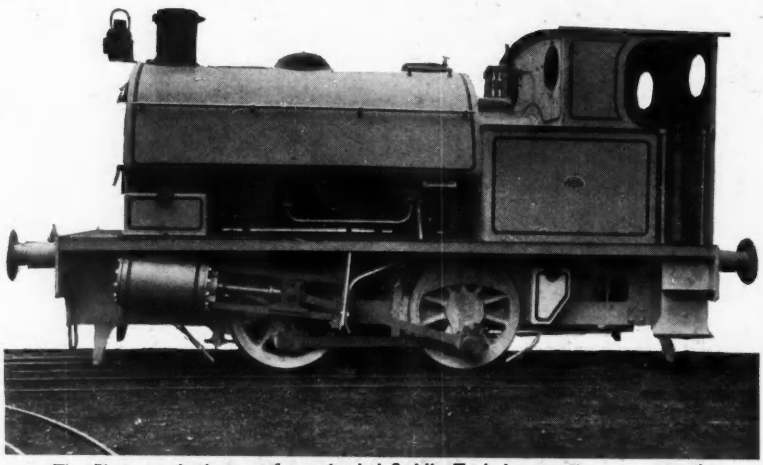

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